Stated preferences of non-industrial private forest owners for a novel permanent conservation program in Finland

Tiina Paajanen
Master's thesis
Environmental and Natural Resource Economics
Department of Economics and Management
University of Helsinki
October 2020

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

Faculty	Degree Programme
Faculty of Agriculture and Forestry	Master's Programme in Agricultural, Environmental and Resource Economics (AGERE)

Author

Tiina Pauliina Paajanen

Title

Stated preferences of non-industrial private forest owners for a novel permanent conservation program in Finland

Subject/Study track

Environmental and Natural Resource Economics

Level	Month and year	Number of pages
Master's Thesis	October 2020	43

Abstract

Forests are vital for biodiversity and climate change mitigation through carbon storage and sequestration. In Finland, forests are the most important renewable natural resource and forestry is significant for the national economy. In addition, forests are the largest carbon sinks of the land use, land-use change and forestry (LULUCF) sector and provide remarkable amount of biodiversity. The Finnish non-industrial private forest (NIPF) owners have significant potential to supply ecosystem services and have substantial opportunities regarding the forests, as 60% of the total area of forest land is privately owned. The NIPF owners may enhance the state of biodiversity and carbon sequestration by participating in the forest conservation programs. The regulations and inclusion of the LULUCF sector in the climate targets of the European Union (EU) and a 30% conservation target of land in the EU Biodiversity Directive are intensifying the pressure on further development of conservation programs. Hence, it is important to understand the behavior of the NIPF owners to motivate the program participation.

The aim of the thesis is to get insight into the Finnish NIPF owners' participation behavior in permanent forest conservation programs by using the choice experiment (CE) method. A novel conservation program is being planned in Finland and this survey processes it for the NIPF owners by using a survey questionnaire. The survey questionnaire was targeted to 5,010 NIPF owners and the overall response rate was 11.7%. The study provides analysis on specific non-participant group of protesters, attribute preferences of the conservation program as well as estimates of the willingness to accept (WTA) compensation for program participation. The forest conservation program is described with four attributes being the payment for biodiversity; payment for carbon sequestration; conduction of non-timber businesses and eligibility of the forest area. The sources behind preference heterogeneity regarding the conduction of non-timber businesses and eligibility of the forest area are examined using interactions in the econometric model.

The results reveal that a significant share (77%) of serial non-participants are identified as protesters and should be excluded from the WTA estimates. Several socio-economic and attitudinal characteristics were found to statistically significantly influence on protest behavior. The probability to protest increases with e.g. older age, pensioners, female gender and renters for hunting club. Additionally, the protest behavior depends on a number of stated attitudinal statements. Using a binary logit model, the model estimates show that the WTA for program participation is considerably higher when protesters are included, being 16,032 €/ha and respectively 5,641 €/ha, when protesters are excluded. The results regarding the preferences reveal attitudinal and socio-economic aspects affecting statistically significantly on the program attribute of the eligibility of forest area. According to the analyses, the possibility to conduct non-timber businesses is rather irrelevant for the respondents. In addition, there are a few attitudinal factors that influence the preferences of the conduction of non-timber businesses which are statistically significant. However, none of the socio-economic factors regarding the preferences of the attribute are statistically significant.

To our knowledge, this is the first study that aims to explain the sources behind protest behaviour as well as to investigate the conduction of non-timber businesses, in the context of permanent forest conservation program. The results provide novel information about protesters and preferences of program attributes of forest management requirements and conduction of non-timber businesses. The results may be useful for the development and targeting of voluntary forest policies and incentives as well as for the business development of organizations that provide services for the NIPF owners. Further, the results help recognizing protesters more easily and reducing protest behavior. To conclude, further studies on the objectives of protests in the context of permanent forest conservation program could be valuable. In addition, further examination on individual attribute level WTAs, could be useful to reveal detailed information of the program attributes of conduction of non-timber businesses and required management activities.

Keywords

Forest conservation, PES program, non-industrial private forest owners, biodiversity, carbon sequestration, climate change mitigation, the choice experiment method

Supervisor or supervisors

Anna-Kaisa Kosenius

Where deposited

Helda E-thesis

Additional information

This thesis is part of the Integrated Biodiversity Conservation and Carbon Sequestration in the Changing Environment (IBC-Carbon) project.

Tiedekunta	Koulutusohjelma
Maatalous-metsätieteellinen tiedekunta	Maatalous-, ympäristö- ja luonnonvaraekonomian maisteriohjelma (AGERE)

Tekijä

Tiina Pauliina Paajanen

Työn nimi

Stated preferences of non-industrial private forest owners for a novel permanent conservation program in Finland

Oppiaine/Opintosuunta

Ympäristö- ja luonnonvaraekonomia

Työn laji	Aika	Sivumäärä
Masteritutkielma	Lokakuu 2020	43

Tiivistelmä

Metsät ovat elintärkeitä luonnon monimuotoisuudelle sekä ilmastonmuutoksen hillitsemiselle hiilensidonnan ja hiilinielujen kautta. Suomessa metsät ovat tärkein uusiutuva luonnonvara ja metsätalous on merkittävää kansantaloudelle. Metsät ovat myös Suomen maankäyttö, maankäytön muutos ja metsätalous (LULUCF) -sektorin suurimmat hiilinielut ja sisällyttävät merkittävän määrän luonnon monimuotoisuutta. Suomalaisilla yksityismetsänomistajilla on merkittäviä mahdollisuuksia metsiensä suhteen sekä potentiaalia toimittaa ekosysteemipalveluja, sillä 60 % metsämaan kokonaispinta-alasta on yksityisomistuksessa. Yksityismetsänomistajat voivat parantaa metsäluonnon monimuotoisuuden tilaa ja hiilensidontaa osallistumalla metsänsuojeluohjelmiin. Yksityismetsänomistajien osallistumismotivointi on tärkeää, sillä Suomen painetta kehittää suojeluohjelmia kasvattavat niin Euroopan Unionin (EU) LULUCF-sektorin sääntely ja sisällyttäminen ilmastotavoitteisiin kuin biologista monimuotoisuutta koskeva direktiivi, johon sisältyy esimerkiksi kolmenkymmenen prosentin maansuojelutavoite, jolla noin kaksinkertaistetaan suojelun määrä Euroopassa.

Tutkielman tavoitteena on saada käsitys suomalaisten yksityismetsänomistajien osallistumisesta pysyviin metsänsuojeluohjelmiin käyttäen valintakoemenetelmää. Suomessa suunnitellaan uutta metsänsuojeluohjelmaa, jota tämä tutkimus testaa yksityismetsänomistajille verkkokyselylomakkeen avulla. Kyselylomake suunnattiin 5010:lle yksityismetsänomistajalle läpi Suomen, ja vastausprosentti oli 11,7 %. Tutkimuksessa keskitytään analysoimaan erityisesti tiettyjä sarjakieltäytyjiä, protestoijia; suojeluohjelman ominaisuuksien mieltymyksiä sekä estimoidaan hyväksymishalukkuutta metsänsuojeluohjelmaan osallistumisen korvauksesta. Suojeluohjelmaa kuvataan neljällä ominaisuudella, jotka ovat: korvaus monimuotoisuudesta, korvaus hiilensidonnasta, ei-puuntuotannollisen liiketoiminnan harjoittamisen mahdollisuus sekä metsäalueen kelpoisuus suojeluohjelmaan. Kahden jälkimmäisen ominaisuuden mieltymyksiä analysoidaan käyttämällä interaktiomuuttujia osana ekonometrista mallia (binary logit -malli).

Tutkielman tulokset osoittavat, että merkittävä osa sarjakieltäytyjistä (77 %) on protestoijia, ja tulisi täten jättää ulkopuolelle arvioitaessa hyväksymishalukkuutta suojeluohjelman osallistumisen korvauksesta. Tulokset paljastavat useita sosioekonomisia ja asenteellisia tekijöitä, jotka vaikuttavat tilastollisesti merkitsevästi protestikäyttäytymiseen. Useiden asenteellisten tekijöiden lisäksi protestikäyttäytymisen todennäköisyyttä kasvattaa muun muassa vanhempi ikä, eläkkeellä olo, naissukupuoli sekä metsästyskerhon maanvuokraajana oleminen. Ekonometrisen mallin estimaatit osoittavat, että hyväksymishalukkuus ohjelman osallistumisen korvauksesta on huomattavasti suurempi, kun protestoijat ovat mukana analyysissa, ollen 16 032 €/ha, ja 5641 €/ha, kun protestoijat eivät ole analyysissa mukana. Tulokset ohjelman ominaisuuksien mieltymyksistä osoittavat sekä sosioekonomisia, että asenteellisia tekijöitä, jotka vaikuttavat tilastollisesti merkitsevästi mieltymyksiin vaadittuja luonnonhoitotoimenpiteitä kohtaan. Lisäksi analyysit osoittavat, että ei-puuntuotannollisen liiketoiminnan harjoittamisen mahdollisuus ei ole merkityksellinen vastaajien kannalta. Muutaman tilastollisesti merkitsevän asenteellisen tekijän lisäksi, mikään sosioekonominen tekijä ei vaikuta tilastollisesti merkittävästi ei-puuntuotannollisen liiketoiminnan ominaisuuden mieltymyksiin.

Tietojemme mukaan tämä on ensimmäinen tutkimus, jonka tarkoituksena on selittää protestikäyttäytymisen taustalla olevia tekijöitä sekä tutkia ohjelman ominaisuuden, ei-puuntuotannollisen liiketoiminnan, toteuttamismahdollisuuksia pysyvän metsänsuojeluohjelman kontekstissa. Tutkielman tulokset antavat uutta tietoa protestoijista sekä ei-puuntuotannollisen liiketoiminnan mahdollisuuksista yhtenä ohjelman ominaisuutena. Tulokset voivat olla hyödyllisiä, kun vapaaehtoisia politiikan kannustimia kehitetään ja kohdistetaan sekä myös yksityismetsänomistajille palveluja tarjoavien organisaatioiden liiketoiminnan kehittämisessä. Tuloksia voidaan myös käyttää protestoijien helpompaan tunnistamiseen ja protestikäyttäytymisen vähentämiseen. Jatkotutkimukset suojeluohjelman yksittäisten ominaisuuksien korvauksien hyväksymishalukkuudesta sekä protestoinnin kohteista voisivat olla hyödyllisiä pysyvän metsänsuojeluohjelman suunnittelun kannalta.

Avainsanat

Metsänsuojelu, PES-ohjelma, yksityismetsänomistajat, monimuotoisuus, hiilidioksidin sitominen, ilmastonmuutoksen hillitseminen, valintakoemenetelmä

Ohjaaja tai ohjaajat

Anna-Kaisa Kosenius

Säilytyspaikka

Helda E-thesis

Muita tietoja

Tutkielma on osa IBC-Carbon hanketta, joka keskittyy metsäluonnon monimuotoisuuden suojeluun ja hiilen sitomiseen muuttuvassa ympäristössä.

Table of Contents

1 Introduction

One-third (33%) of the total land area of the world is covered by forests (Food and Agriculture Organization of the United Nations, 2020). The forest management and use are influenced by the global megatrends, such as climate change, digitalization, urbanization, globalization, technological development and population aging (Retief et al, 2016; Intergovernmental Panel on Climate Change, [IPCC] 2018). Climate change is a major global challenge and is addressed by reducing the greenhouse gas (GHG) emissions in order to curb global warming (IPCC, 2018; Ministry of the Environment, 2018b). Forests are vital for climate change mitigation through carbon storage and sequestration (IPCC, 2019) and for biodiversity habitat supply (Millennium Ecosystem Assessment, 2005). Paris Agreement, an international agreement adopted in 2015, strives to combat climate change and stabilize its global effects and risks by aiming to hold the global average temperature rising well below 2 degrees Celsius (°C) of pre-industrial levels, and promotes the efforts to restrain the temperature increase to 1.5°C. In order to achieve the temperature goal, the GHG emissions must be reduced rapidly and the GHG removals need to be conserved and enhanced. (United Nations, 2015.)

In addition to climate change, the loss of biodiversity is another major global crisis (IPCC, 2018). Biodiversity is fundamental for both the Paris Agreement and the Agenda 2030 for Sustainable Development Goals. For instance, approximately a third of the GHG emission reduction goals of the Paris Agreement may be originated from nature-based solutions. (Secretariat of the Convention on Biological Diversity, 2020). Since the 1950s, the human-driven ecosystem degradation has worsened e.g. due to the increased demand for food, water and wood. Although anthropogenic-based changes on ecosystems have contributed to the economic development and increased human well-being, it has caused degradation and loss of several ecosystem services. The human activities burden and even exhaust the natural capital, causing direct and indirect changes in ecosystems. (Millennium Ecosystem Assessment, 2005.)

The protection of biodiversity has been a policy focus already for several decades and the United Nation's Convention on Biological Diversity is the main agreement preserving biodiversity. The agreement has been ratified by 193 parties including the European Union (EU) and was entered into force in 1993. The purpose of the Convention on Biological Diversity is to preserve ecosystems, plants and animal species; to promote the sustainable use of natural resources and to protect the fair share of the benefits from genetic resources. (United Nations, 1992.) In 2010, the signatory nations

committed to the Aichi Biodiversity Targets, which aimed to halt the loss of biodiversity by 2020 (United Nations, 2010a). The strategic goals of Aichi contained 20 targets, including forest-related targets to at least halve the loss of habitats; ensure sustainable forestry and biodiversity conservation; cover 17% of terrestrial land; and contribute biodiversity to climate change mitigation and adaptation through carbon stocks, implementing conservation and restoration. (United Nations, 2010b.) However, the Aichi Biodiversity Targets were not met, and a new Global Biodiversity Outlook has been published in 2020 (Secretariat of the Convention on Biological Diversity, 2020).

Forests are a crucial part of the global carbon cycle as forest ecosystems store more than 80% of the terrestrial aboveground carbon of the world (D'Amato et al, 2011). The grown demand of natural resources, including timber, has raised the concerns about the intensity of forest management (Ficko et al, 2017). Forest management practices change the composition of forests, and may thereby cause loss and fragmentation of old forests and decreased number of decaying trees, which both contribute to the endangerment of forest species (Hanski & Hammond, 1995). Hereby, the development of forest management strategies, which address climate change and biodiversity loss, have achieved increased importance. The sustainable forest management may diminish and reduce the land degradation and thus, contribute to climate change mitigation and adaptation. (IPCC, 2019.) For instance, the sustainable forest management strategies contribute to climate change adaption by keeping the composition and structure of the forest complex and to climate change mitigation by improving carbon storages (D'Amato et al, 2011). Moreover, forest management practices, such as, rotation time, thinnings and management regimes alter the carbon storage and sequestration (Krankina & Harmon, 2006).

Besides commodity goods such as timber, forests provide various public goods and ecosystem services, such as berries, recreational values and carbon sequestration (Juutinen, 2015). The environmental benefits, that are obtained from the natural environment by human, are called ecosystem services. Plants, animals, microorganisms and the non-living environment form a dynamic complex called ecosystems, where human and other components of ecosystems are interacting. Ecosystem services can be divided into four categories: supporting services (e.g. carbon cycle) that enable other categories of ecosystem services; provisioning services, such as raw material (e.g. timber); regulating services (e.g. carbon sequestration); and cultural services (e.g. recreation and landscape) (Millennium Ecosystem Assessment, 2005).

1.1 Climate and biodiversity policies in Finland

Finland is relatively the most wooded country of Europe as two-thirds (67%) of the land area is covered by forests (Ministry of Agriculture and Forestry of Finland, 2019b). On one hand, forests are the most important renewable natural resource and forestry is a significant contributor for the national economy. In 2018, 78.2 million cubic meters of timber was felled from the forests in total. For comparison, the annual average between 1991-2018 has been 59.5 million cubic meter per annum. (Natural Resources Institute Finland, 2019.) On the other hand, forests are the largest carbon sinks of land use, land-use change and forestry (LULUCF) sector in Finland. The carbon sinks of forests have fluctuated between 20-50 million metric tons of carbon dioxide equivalents (Mt CO2-eq) between 1990-2013. Correspondingly, the carbon sinks of forests have covered 30-60 percentage of the total emissions of Finland. The objective of Finland's forest use is to increase the use of timber in product and energy production to 80 million cubic meters per annum. In the period 2021-2030, the forest carbon sinks are estimated to be between 13-20 Mt CO2-eq, however increasing towards 2030. While the use of timber is increased and the carbon sinks of the forests have shrunken, the focus of climate change mitigation will be in replacing fossil raw materials with renewable raw materials, such as wood. (Ministry of Economic Affairs and Employment, 2017.)

Finland aims to decrease the anthrophonic GHGs at least 80% by 2050, compared to the 2005 levels (Ministry of the Environment of Finland, 2018). The National Energy and Climate Strategy determines the main policy outlines and objectives in order to meet the Finnish 2035 carbon neutrality goal. The strategy includes both emission trading sector and non-emission trading sector, which is also called effort sharing sector. In addition, the National Energy and Climate Strategy aligns the importance to influence the EU's LULUCF regulation, which imposes how land use, land use change and forestry are taken into account in forthcoming climate policies, in order to ensure increased, yet sustainable, and versatile use of forests. The sustainable use and management of forests is insured by maintaining the health of the forests; by strengthening the growth of forests and carbon sequestration in long-term; and by implementing the measures of a National Forestry Strategy 2025. (Ministry of Economic Affairs and Employment of Finland, 2017.) The National Forest Strategy strives to achieve the forest-related Sustainable Development Goals of Agenda 2030. In also includes the forest development proprieties and measures in which the public sector will target, considering climate resilient forestry and the aspects of biodiversity conservation. According to the National Forest Strategy, the active management and use of forests will maintain the health and growth potential of

the forests, the latter being the main requirement for the carbon sequestration capacity of the forests. (Ministry of Agriculture and Forestry of Finland, 2019c.)

There is a total of 2,247 species in Finland that are classified as endangered, from which 36% have forest as their primary habitat. Almost half of the endangered forest species live in herb-rich forests and over one-third in old forests. (Finnish forest statistics, 2018.) Finnish government promotes private forest owners' voluntary and incentive-based forest biodiversity protection in Southern Finland through the METSO Programme, which combines forest conservation and economic use. The METSO Programme started in 2014 and continues at least until 2025. The purpose of the program is to halt the deterioration of forest habitats, species and ecosystems and support the development of forest biodiversity by 2025. The NIPF owners can voluntarily protect forest biodiversity by offering their forests to the METSO Programme. (Ministry of Agriculture and Forestry of Finland, 2019a.) The program is implemented either as a permanent protection, temporary conservation or as a nature management projects. The forest owner obtains financial compensation for protection and nature management (METSO, 2019).

The inclusion of the LULUCF sector in the EU's climate targets and a 30% conservation target of land in the EU Biodiversity Directive, i.e. doubling the amount of protection, put pressure on the further development of conservation programs (European Commission, 2020). Finland aims to halt the loss of biodiversity and achieve the goals of the Convention on Biological Diversity by continuing, renewing and funding the METSO Programme. In addition, the nature management practices of commercial forests will be promoted e.g. leaving deadwood, stumps and buffer zones of water systems. Further, the continuous cover forestry will be promoted in the government-owner forest lands. (Publications of the Finnish Government, 2019.) The Finnish parliament has allocated an additional 100 million euros for nature conservation and habitat restoration for 2020. Alongside the METSO Programme, the voluntary Helmi habitats programme for landowners was established in 2020, to which, 42 million euros of the additional appropriation are to be allocated. The Helmi programme aims to strengthen biodiversity, support ecosystem services as well as contribute to climate change mitigation and adaptation. The target is in particular to halt the biodiversity loss by helping endangered species and habitats. (Ministry of the Environment of Finland, 2020).

Of the total 30.4 million hectares (mill. ha) of land area in Finland, 86% is covered by forestry land, 9% by agricultural land and the rest 5% by built-up areas and transport routes etc. Of the total 26.2

mill. ha of forestry land, approximately 77% is forest land, 10% is poorly productive forest land, 12% is unproductive land and 1% is other forestry land, presented accordingly in Figure 1. The size of the total area of forestry land is affected by factors such as construction, agricultural use of fields, peatland use (e.g. ditching or peat production) and water reservoirs. Approximately one-third of forestry land are mineral soils and two-thirds peatlands. (Finnish forest statistics, 2018.)

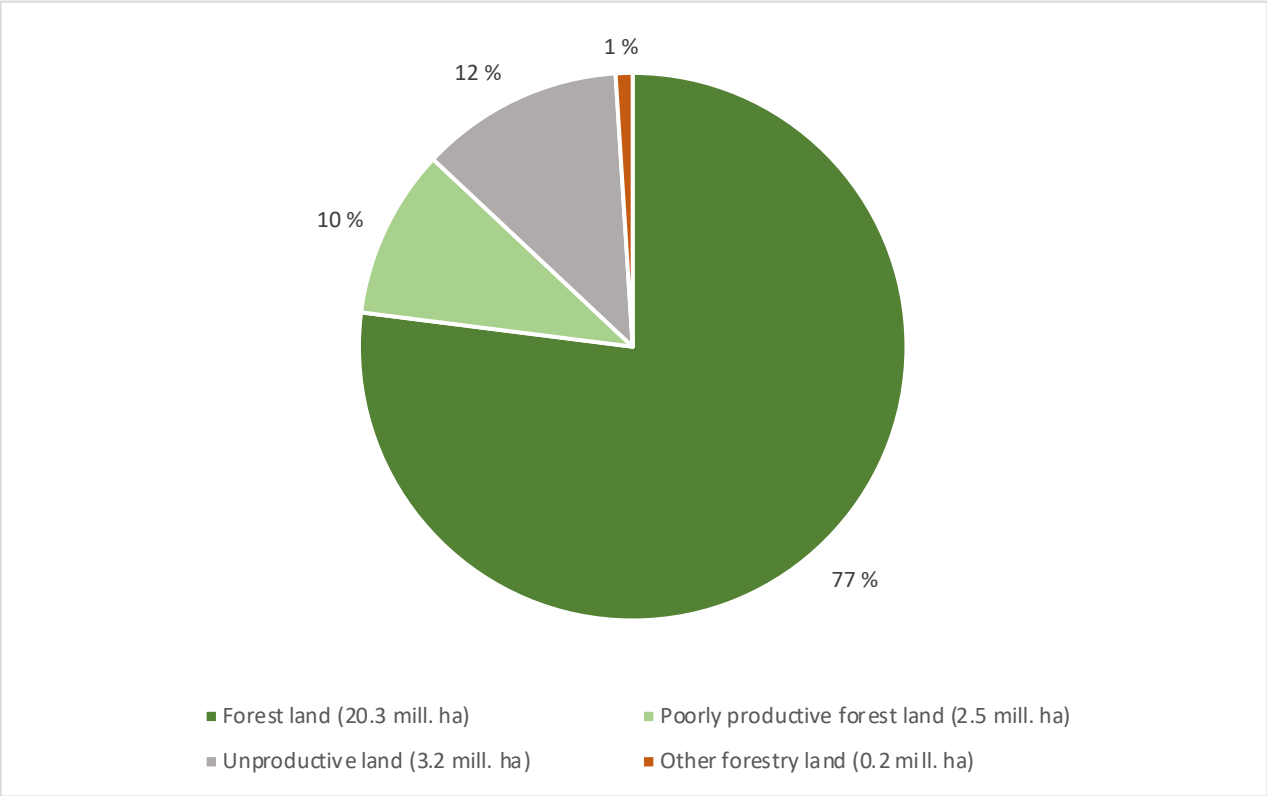


Figure 1. The share of the forestry land in Finland (Finnish forest statistics, 2018).

In the beginning of 2019, Finland has approximately 13% of its forest land and poorly productive forest land protected. The 2.9 million hectares of protected forests consist of statutory protected areas and biodiversity conservation sites. Approximately 83% of the protected forests are statutory protected areas, e.g. a nature reserve established under the Nature Conservation Act, and 17% are biodiversity conservation sites located in commercial forests. Of all the protected forests, approximately 10% are strictly protected, meaning that forestry is not allowed. (Official Statistics of Finland, 2019a.)

There are large regional differences in protected forest areas in Finland. Approximately 79% of the protected forests are located in the Northern Finland (Northern Ostrobothnia, Kainuu and Lapland),

which covers 20% of the forest land and poorly productive forest land of the Northern Finland. Correspondingly, 21% of the protected forests are located in the Southern Finland, covering only 5% of the forest land and poorly productive forest land of Southern Finland. (Official Statistics of Finland, 2019a.) Besides preserving biodiversity through forest protection, biodiversity shall be considered in commercial forests by saving deciduous trees, reserve trees and decayed trees as well as by favoring mixed forests. In addition, valuable natural sites such as habitats of special importance (protected by the Forest Act) and protected natural habitats (protected by the Nature Conservation Act), are excluded from forest management activities. (Finnish forest statistics, 2018.)

1.2 Non-industrial private forest owners in Finland

The structure of forest ownership is going through a change. In Europe, including Finland, the number and area of private forest holdings have increased from 1990's until today. The major driver for this change is the structural change of agricultural sector and family farming system. In the past, small-scale forestry and forest ownership was connected to farming. However, changes in agricultural sector have inflicted gradual degrading of forestry such as novel fragmentation of forest land, forms of ownership and lack of forest owners' involvement. (Ficko et al, 2017.) In Finland, changes in economic structure, increased disparities in regional development and internal migration have clearly changed the forest ownership (Karppinen, Hänninen & Horne, 2020). Since the 1990's, the most typical features of the change in forest ownership structure have been the declining share of farmers; the relocation of forest owners through urbanization; aging forest owners and changes in the structure of forest holdings. This implies to fragmentation of forest holdings but also increased size of large forest holdings. (Hänninen & Karppinen, 2010.) The distribution of inheritance may cause the fragmentation of forest holdings and trading of forest holdings may cause the increased size of forest holdings (Official Statistics of Finland, 2019b). In addition, Finland's accession to the EU, in 1995, impacted on the increased size of agricultural holdings as many small-scale farmers quit (Kuuluvainen et al, 2014). Moreover, within the past decade, both the structure of forest ownership community and the operating environment has changed. On one hand, the Forest Act that entered into force in 2014 increased the freedom of choice in use and management of forests. On the other hand, Finland is committed to international and EU-level programs and legislation, that may restrict the decision-making of the forest owner. (Karppinen et al, 2020).

Finland has approximately 344,000 privately owned forest holdings (at minimum of 2 hectares). These forest holdings are owned by the 620,000 NIPF owners and the average size of a forest holding is 30.5 hectares. The difference between the number of the NIPF owners and private-owned forest holdings is explained by a joint ownership. Of the privately-owned forests, 74% are owned alone or with a spouse, 17% are co-owned by consortiums and 9% have remained undistributed by heirs. Moreover, the significance of the NIPF owners is emphasized as approximately 60% of the total area of forest land is privately owned. On top, the state owns 26% of the forest land, corporations 8%, jointly owned forest 3% and municipalities 2%. (Official Statistics of Finland, 2019b.) Of the forestry land, more than half (52%) is privately owned, 35% is state owned, 7% is owned by companies and the rest 6% owned by municipalities, parishes and associations (Finnish forest statistics, 2018).

Of the total stand volume (2,473 mill. m^3) on forest land and poorly productive forest land, 80% are from privately owned forests. The state provides 10% and the forest corporations 10% of the domestic raw wood used by forest industry. Moreover, the NIPF owners provide 70% of the annual growth of wood stock that is 107 million cubic meters count on forest land and on poorly productive forest land. (Finnish forest statistics, 2018.) Figure 2 compares the proportions of stock volume and annual stock growth counted on forest land and poorly productive forest land together with proportions of the ownership groups on forestry land. Furthermore, regional differences between ownership groups explain the higher stand growth and fellings of privately-owned forests. (Official Statistics of Finland, 2019b.) The mean annual increment of stock growth is 6.8 m^3 per hectare in Southern Finland while it is only 3.2 m^3 per hectare in Northern Finland (Finnish forest statistics, 2018). The majority of the private owned forests are located in lush areas in Southern Finland whilst the state-owned forests are mostly located in Eastern and Northern Finland (Official Statistics of Finland, 2019b).

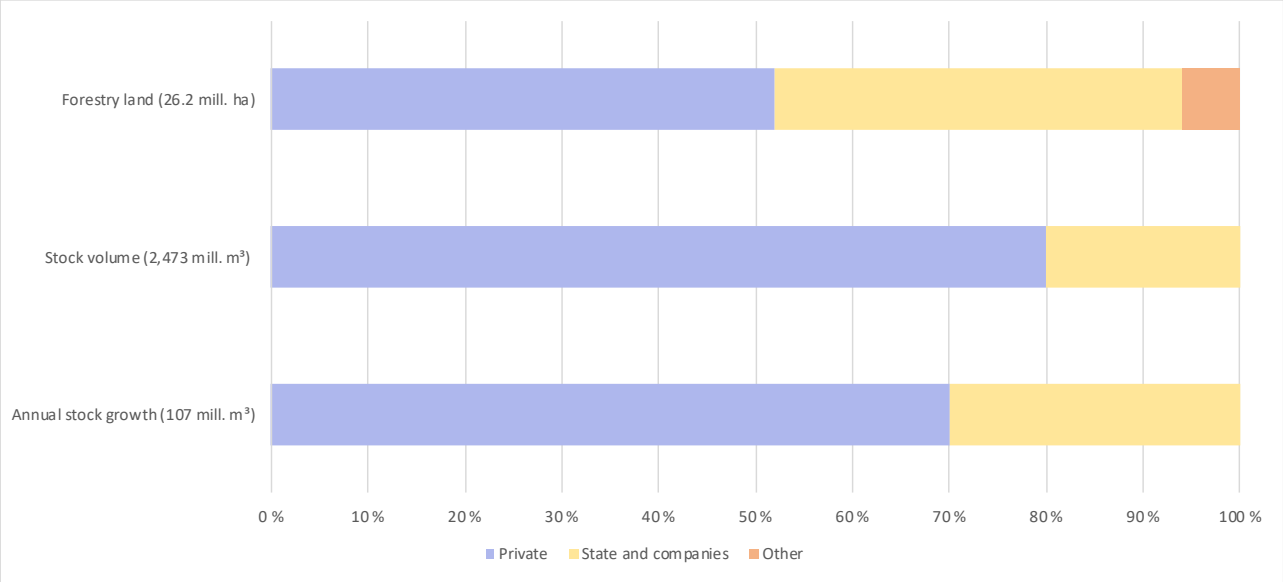


Figure 2. Proportions of ownership groups of forest land as well as stock volume and annual stock growth on forest land and on poorly productive forest land (Finnish forest statistics, 2018).

The Finnish NIPF owners have diverse characteristics, ownership forms and objectives, that affect the forest management decisions and willingness to conserve forests (Official Statistics of Finland, 2019b; Hänninen, Karppinen & Leppänen, 2011). Since 1970s, the Finnish Forest Research Institute (currently a part of the Natural Resources Institute Finland) has conducted surveys targeted to the NIPF owners every 10 years. The most recent survey was implemented in 2019 and published in 2020. To mention a few changes over the past decade, the share of the NIPF owners permanently living on the forest holding and full-time farmers have decreased. In addition, the share of employees and educated forest owners have increased and the forest-owner household's average income level has risen to be higher than the average for households. (Karppinen et al, 2020.)

The forest owner objectives have changed towards a surprising direction within the past ten years (Karppinen et al, 2020). Hänninen et al (2011) grouped the Finnish NIPF owners by the objective of the forest ownership. The authors found that 30% were multi-purpose, meaning that in addition to economic objectives, the intangible benefits are also emphasized; 24% were recreational users; 20% got living from the forest; 16% emphasized financial security and income; and 10% were unaware. Contrary to expectations, the results indicated that the intangible objectives have not strengthened over the past decade. The share of the multi-purpose NIPF owners decreased from 30% to 28% and the share of recreational users decreased from 25% to 20%. Further, the share of the forest owners that get the living from the forest slightly increased from 20% to 21% and the share of the NIPF

owners who accentuate financial security increased from 16% to 20%. Finally, the share of the "unaware" group somewhat increased from 10% to 11%. (Karppinen et al, 2020.)

1.3 Literature review

Both domestic and international studies have examined the NIPF owners' participation and attitudes towards PES program that enhance carbon sequestration, protect forest biodiversity or species habitat. This brief review includes previous academic literature on biodiversity conservation and carbon sequestration, where the studied aspects of the PES program are factors influencing participation or the willingness to participate in such programs. The literature is selected based on the criteria that 1) the study investigates voluntary forest PES programs 2) the aim of the program is to protect forest biodiversity, habitat or improve carbon sequestration and 3) the study is conducted as a survey-based choice experiment (CE). The literature review includes studies from Finland, Norway, Sweden and the United States. Among the forest-related PES program studies, the ones that examined forest management decisions within the program instead of conservation, were excluded. In addition, the studies that use other stated preference method instead of the CE, were excluded. Additionally, the studies published more than 15 years ago were excluded as they may not reflect the up-to-date opinions and circumstances of the NIPF owners.

The NIPF owners' preferences and attitudes towards voluntary forest conservation programs are related to many factors such as the contract characteristics, forest holding characteristics and forest owners' characteristics, including the ownership objectives, to mention a few. The studied attributes of the NIPF owners' characteristics include age, education level, gender, income and length of ownership. Examined characteristics of forests include the age, structure, size, previous harvest, type and tree species, for example. (Dickinson et al, 2012; Horne, 2006; Håbesland et al, 2016; Kang et al, 2019; Layton & Siikamäki, 2009; Mitani & Lindhjem, 2015; Nordén et al, 2017; Rabotyagov & Lin, 2013; White et al, 2018.) Table 1 compares the characteristics of PES programs, i.e. attributes and different levels of attributes, examined in the previous literature. Examined program attributes include contract length, payment and payment type, initiator, restrictions on forest use, requirements, to mention a few. Although the studies typically have common program attributes, such as the duration of the program, quite a wide range of attributes have been examined. In most of the cases, the programs are examined by using multiple attributes and attribute levels. However, in contrary, a Norwegian study by Mitani & Lindhjem (2015) has only two attributes with no varying attribute levels. The authors examine the driving motivations of participation in a novel permanent program

that was binding also for the possible future forestland owners and had one-time payment, based on the amount of the loss of net timber revenues.

Table 1. A comparison of PES program attributes and attribute levels.

Author(s)	Horne	Layton and Siikamäki	Dickinson et al.	Rabotyagov and Lin	Håbesland et al.,	White et al.,	Kang et al.
Year	2006	2009	2012	2013	2016	2018	2019
State	Finland	Finland	USA/Massachusetts	USA/Washington	Norway	USA / Vermont	USA / Georgia
Aim of the PES program	Biodiversity	Endangered species and habitat	Carbon sequestration	Biodiversity	Carbon sequestration	Carbon sequestration	Biodiversity
PES program attributes and the attribute levels:							
Contract duration	5 years 10 years 30 years 100 years	10 years 15 years 20 years 25 years 30 years 35 years 40 years 45 years 50 years	5 years 10 years 15 years	10 years 30 years 50 years Permanent	10 years 25 years 50 years	20 years 60 years 100 years	10 years 30 years 60 years Permanent
Annual payment	0 €/ha 70 €/ha 140 €/ha 210 €/ha 280 €/ha 350 €/ha	85-11,770 €/ha the levels not known	$5 / acre $15 / acre $30 / acre	$25 / acre $50 / acre $100 / acre $200 / acre	50 NOK/ha 200 NOK/ha 400 NOK/ha 600 NOK/ha	$5 / acre $10 / acre $15 / acre	$10 / acre $30 / acre $60 / acre $80 / acre
Cancellation policy	Forest owner can cancel New owner can cancel Binds also new owner		Withdrawal penalty No penalty			No penalty $50 $100	
Initiator	Forest owner themselves Forest organisation Environmental org. Conservation trust					For-profit company Non-profit company Government org.	
Restrictions on forest use	Small patches protected Nature management plan No silvicultural practises Strict nature reserve						No restriction Increased plantation size not allowed
Forest management requirements			Management plan required No requirements	Management approach increasesing biodiversity required No requirements			
Extent of forest conservation				0 > 1/3 of the stand 1/3 > 2/3 of the stand 2/3 > entire stand Entire stand			
Payment mode							Cash Tax credits
Streamside Management Zone width							40 feet 70 feet 100 feet 150 feet

A Finnish study by Horne (2006), studied the factors influencing to the acceptance of forest biodiversity conservation contracts as well as the required amount of payment to keep the welfare of forest owners' unharmed. The research dates back to a time when METSO was only a pilot project investigating incentive-based mechanisms of voluntary forest protection for the NIPF owners. Horne investigated forest owner characteristics and program characteristics but not forest holding characteristics. The results show changes in well-being as the terms of the contract change, indicating that the forest owner should be compensated accordingly in order to maintain the welfare same. Another Finnish study, by Layton & Siikamäki (2009), focused on examining the opportunity cost of participating in the PES program of endangered species and habitats as well as the participation preferences, in order to develop emerged forest conservation in Finland. The study was conducted

three years later than the study by Horne, also at the time before METSO Programme, but at a time when a large expansion of conservation program was being considered in Finland. The objective of the study was to provide data and information on possible enrollment for the potentially expanding forest conservation program. Besides forest owner and forest holding characteristics, the contract characteristics were examined by Layton and Siikamäki. The results highlight that contract characteristics, forest owner characteristics and forestland characteristics may all impact the opportunity cost of participation.

A study from Massachusetts, the United States, by Dickinson et al (2012), examined the likelihood of the NIPF owners' participation in private and government-sponsored carbon sequestration programs. The results indicate that even the forest landowners are motivated by the economic factors, the likelihood of participation is fairly low. According to the results, the participation is less likely when the program has more requirements, is more binding and has possible sanctions. A Norwegian study by Håbesland et al (2016) examined the participation motivation factors of carbon sequestration offset program. The aim of the study was to investigate the NIPF owners' interests in increasing carbon sequestration on their land and selling carbon credits. The results indicate that a considerably amount of the Norwegian NIPF owners (48%) would be interested in participating carbon sequestration offset programs. However, the participation would significantly be affected by the payment amount, required management actions and the attitude towards intangible forest amenities and climate change. Furthermore, a study by White et al (2018), focused on carbon credit programs, examining attribute preferences and characteristics affecting the willingness to accept (WTA) compensation. The authors found several factors influencing to the program preferences. For example, the revenue from the program was found to be the most important factor of the carbon program. In addition, the non-profit organizations could potentially be the initiators of a novel carbon offset projects in Vermont. The estimated WTA of the carbon credit program was measured at the individual attribute level, instead of program level.

A study from the United States, by Rabotyagov & Lin (2013), investigated various characteristics and attribute preferences regarding biodiversity conservation contracts. The results indicate significant attribute preferences heterogeneity, depending on forest owner objectives and forest land characteristics, in particular harvesting behavior. Lastly, a study from Georgia, the United States, by Kang et al (2019), examined whether and how forest property characteristics, and especially forest management decisions, are related to the NIPF owners' preferences towards the biodiversity

conservation program. The results indicate the importance of the characteristics of forest property when identifying and targeting the programs to forest owners. The results reveal that planted pine forests, bottomland hardwood forests and residential structures affect the participation likelihood and WTA compensation for participation. The estimated WTA was measured at the individual attribute level.

1.4 Aim of the study

This thesis is part of the Integrated Biodiversity Conservation and Carbon Sequestration in the Changing Environment (IBC-Carbon) project. The aim of the thesis is to get insight of the Finnish NIPF owners' participation behavior in a permanent forest conservation program by using the CE method. A novel forest conservation program is being planned in Finland and this survey tests it for the NIPF owners by using a survey questionnaire to collect the data. In the hypothetical conservation program of the study, the METSO Programme is extended by supplementing its biodiversity-based compensation with carbon-based compensation. The conservation program is described with four program attributes being the payment for biodiversity; payment for carbon sequestration; conduction of non-timber businesses and eligibility of the forest area.

The aim is to focus especially on the reasons for not to participate in the conservation program, estimations of the WTA compensation as well as the preferences for program attributes. More precisely, the aim is to identify the protest responses among the non-participants and compare the estimates of the WTA for program participation with protesters as well as without protesters. To examine the attribute preferences, the respondents' characteristics are added into the econometric model as interactions with the attributes. Theoretical models and literature include only marginally information on the specific attributes of non-timber businesses and the eligibility of forest area. Thus, instead of examining the respondents' characteristics and attitudes based on the literature or theoretical models, the exploratory approach with no anticipation nor hypothesis is tested.

The CE, that is based on a hypothetical scenario and a survey questionnaire data, is particularly a valuable method when exploring a program that is at design stage and has several aspects, which impact the attractiveness of the program. The thesis aims to provide novel information on non-participation and attribute preferences, which may be useful when developing and targeting voluntary forest policies and incentives for the NIPF owners. The thesis is organized as follows: theoretical

framework and methods are described in section 2. Section 3 presents the survey instrument and the data, followed by the results in section 4. Finally, discussion and conclusions are presented in section 5.

2 Theoretical framework and methods

According to the economic theory, the forest should be used and managed in a way that society gains as much well-being as possible. An increase in timber production typically reduces the quality or quantity of other services forests provide and the forests are used too much for wood production and too little to biodiversity protection for the well-being of society. Thus, the benefits and costs of different forms of forest use and management need to be considered in order to guide the functioning of markets and the use of forests through legislation, recommendations, taxes and subsidies. (Juutinen, 2015.)

The private forest owners may have a significant role in provisioning ecosystem services, and the supply and condition of such services may strongly depend on the management decisions on private owner land (Hanley & White, 2014). For example, the production of ecosystem services may be increased on private forest lands through conservation. However, the conservation may be challenging because of the non-market nature of ecosystem services and because the conservation may require voluntary participation from private forest owners. (Kline et al, 2013). There may be several reasons why private forest owners might be unwilling to provide increased supply of ecosystem services. For example, private forest owners may not be motivated to enhance ecosystem services if the effort is not compensated. (Grebner, Bettinger & Siry, 2012.) Additionally, the increased supply of ecosystem service may create costs as an opportunity cost to landowner (Hanley and White, 2014). However, the willingness to provide ecosystem services may increase in the presence of sufficient monetary compensation (Zhang, 2016). Hence, it is crucial to promote the private forest owners to participate to incentive-based programs as the participation is voluntary (Hanley et al, 2012; Kang et al, 2019).

This section focuses on the key context and methods of the study and presents the concept of payments for ecosystems services; forest landowner participation model and the CE method including its theoretical foundations and the identification of protest responses, which is an important specific feature of this study.

2.1 Payments for ecosystem services

Payments for ecosystem services (PES) programs are incentive-based policy instruments for resource owners. The idea of PES programs is to financially compensate the resource owner for increasing the

supply of ecosystem services for society. (Wunder, 2005.) The use of PES programs for conservation has been increased worldwide (Wunder, Engel & Pagiola, 2008; Hanley & White, 2014) as they provide "a market-like approach" to secure the ecosystem service supply and biodiversity protection (Hanley & White, 2014). PES programs may be used to improve the attractiveness of the conservation for the private forest owners (Layton & Siikamäki, 2009). PES programs are voluntary transactions where a service buyer purchases a contract to ecosystem service provider. The ecosystem service provider receives the payment only if the ecosystem service is supplied by the ecosystem service provider. (Wunder, 2005). It is crucial that the ecosystem service is additional, meaning that the ecosystem service supply increment has not been already implemented nor would have been implemented without the contract (Wunder et al, 2008). In addition, the ecosystem service supply should be monitored and measured (OECD, 2010). Moreover, the payment mode, seller, buyer and "what is paid for" may range substantially. The payment types include negotiated payments, auctions, uniform payments and different levels of payments. The seller may be e.g. a forest owner or farmer. The buyer may be a government, government agency or company, for example. The payment may be targeted either for management actions, such as measures that increase biodiversity or forest conservation or; for environmental outcomes, such as avoidance of deforestation. (Hanley and White, 2014.) According to the review of Langpap & Kim (2010), the economic incentives may be effective for forest conservation programs, especially if the NIPF owners' ownership objective is not solely timber production. However, the effectiveness of the conservation program may be dependent on the context and thus require case by case examination and consideration.

2.2 Forest owner participation model

The landowner participation decision model by Lynch and Lovell (2003), adapted by Langpap (2004), presents the voluntary participation decision for temporary forest conservation PES program. Mitani & Lindhjem (2015) modified the participation model for permanent PES program, which binds the forest owner for entity. In the model of permanent program by Mitani & Lindhjem (2015), the NIPF owner i has two options: 1) to participate or 2) not to participate in the program. If the landowner chooses to participate, the harvest is banned until forever. If the landowner chooses not to participate, the stand is harvested at the optimal time T.

Landowners achieve different levels of utility from preserving the land as forest; from net revenues of harvesting; from PES program payments and; from non-timber income. Thus, the NIPF owner i

maximizes her utility U_i by choosing p, whether to participate to the program or not. If the forest owner chooses to participate (p_i = 1) in the program the utility of the participation is:

$$V_i^1 = \int_{t=0}^{\infty} U_i \{S_i(x_{i,} 1, t), W_i(x_{i,}1, t),\ qI_i(x_i)\} e^{-rt}\, dt, \quad (1)$$

If the forest owner chooses not to participate (p_i = 0) the utility of the non-participation is:

$$V_i^0 = \int_{t=0}^{T} U_i \{S_i(x_{i,} 0, t), W_i(x_{i,}0, t)\}\, e^{-rt}\, dt + \int_{t=T}^{\infty} U_i \{W_i(x_{i,}0, t), qR_i(x_i)\} e^{-rt}\, dt \quad (2)$$

where x_i is the vector of forest owner's demographic and property characteristics; $R_i(x_i)$ is the net revenues from harvesting at *T*; $S_i(x_{i,}\, t)$ is the non-consumptive value of preserving the land as forest at time *t;* $I_i(x_i, t)$ is the value of the incentives received from participating in the program at time *t;* $W_i(x_{i,}\, t)$ is the non-timber income at time *t;* q is the discount rate and *r* is the time preference of the forest owner. If the participation behavior is rational, meaning that the forest owner aims to maximize her utility, and follows the well-defined utility function, the forest owner chooses to participate in the program if the total utility of participation surpasses the utility of non-participation:

$$V_i^1 > V_1^0 \quad (3)$$

The forest owner participation model assumes that the forest owner's expectations on economic benefits from participation affects the participation decision. Forest owner's utility from participation (equation 1), depends on the expected benefits from the non-consumptive value of preserving the land as forest, non-timber income under the program and the value of the incentives received from participation. Respectively, forest owner's utility from non-participation (equation 2), depends on the expected benefits from non-timber income without the program and the net revenues from harvesting at optimal time *T*. (Mitani and Lindhjem, 2015.)

2.3 The choice experiment (CE) method

The stated preferences (SP) methods are non-market valuation methods that have been applied for decades in environmental and natural resource economics (Holmes et al, 2017, p 134). The SP methods elicits preferences from a survey-based approach in which the idea is to create a hypothetical choice scenario for the survey respondents. The economic value of the non-market good is estimated by utilizing the responses of survey questions that elicit the preferences of the respondents. (Johnston

et al, 2017). The CE is a SP method and is based on the neoclassic consumer theory, where individuals aim to maximize their utility. The attribute theory of value (Lancaster, 1966) is essential for the CE method as the multi-attribute designs and the statement that the value of the good is the sum of its characteristics, are based on the attribute theory of value. The CE method is originally developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983) to model choices on transport and telecommunications (Bennett & Blamey, 2001, p. 13). Recently, the CE method has been applied also in studies that investigate landowners' preferences on PES programs, e.g. Horne (2006), Kang et al (2019), Layton & Siikamäki (2009), Mitani & Lindhjem (2015), Nordén et al (2017), Rabotyagov & Lin (2013) and White et al (2018). In the context of the design of PES program, the CE method allows the estimation the respondents' WTA for program participation.

In a CE study, a survey respondent is asked to assess a series of choice scenarios, which commonly contain attributes and different level of attributes to be considered (Johnston et al, 2017). The respondents are asked to choose the preferred option among alternatives, understanding that the chosen alternative excludes other alternative or alternatives (Segerson 2017, p 23). The choice questions include at least a status quo alternative and another alternative, and the estimated utility function indicates changes from status quo conditions (Holmes et al, 2017, p. 140). The CE method allows to imitate real market behavior in various policy contexts. Thus, the method may be highly useful in a decision-making context, because it is possible to estimate valuations of various policy options (in terms of willingness to pay) in advance and provide support for decisions. (Holmes et al, 2017.) Instead of the WTP, the WTA is particularly investigated in this study because of the PES program in which the service provider receives the payment.

The preference ordering of individual may be expounded through the utility function. According to the neoclassic economic theory, individuals have preferences over market and nonmarket goods. When forming the base of an individual's choice, the economic theory highlights the ability of individuals to put bundles of goods into preference order even without regard to the budget constraint. The utility function over goods may be used to present the preference order for the choice of an individual. An individual aim to maximize the utility U when the income y is used on market good purchases and is subjected to a fixed level of non-market goods. The utility maximation function may be denoted as:

$$max_x\ U(X,Q)\ s.t. PX \leq y,\ Q = Q^0 \qquad (4)$$

where $X = [x_1, x_2, \ldots, x_n]$ denotes to a vector of the levels of market goods *n.* The levels of nonmarket goods *k* are denoted as a vector of $Q = [q_1, q_2, \ldots, q_n]$ and a bundle of goods is denoted as (X, Q). The utility is subject to the relative prices of market goods $P = [p_1, p_2, \ldots, p_n]$ and income that forms the budget constraint. The individuals cannot influence on the levels of the nonmarket goods that are rationed at the level $Q = Q^0$. (Flores, 2017.)

2.3.1 The random utility maximization model

The analysis of the CE survey responses is based on the random utility maximization (RUM) model (McFadden, 1973) extension, where the model estimations stem from the utility differences between the choice set alternatives. Holmes et al (2017, p. 157) present the RUM model assuming that individuals know their utility certainly, but the utility is partly unobservable for the researchers. Hence, the utility function of an individual *k* is assumed to be a sum of systematic components *v* and random components *ε* and may be presented as:

$$V_{ik} = v_{ik}\,(Z_i, y_k - p_i) + \varepsilon_{ik} \tag{5}$$

where the unobservable utility related to the alternative *i* is denoted as V_{ik}. The vector of attributes related to *i* is denoted as Z_i; the cost of *i* is denoted as p_i; the income is denoted as y_i; and the random error term is denoted as ε_{ik} with zero mean. If the aim is to maximize the utility when choosing between alternatives that exclude each other, the individual chooses alternative *i* if the utility of *i* surpasses the utility of another alternative *j.* The choice set alternatives are denoted as *C* and the probability of choosing *i* may be denoted as:

$$P_{ik} = P[v_{ik}(Z_i, y_k - p_i) + \varepsilon_{ik} > v_{jk}(Z_j, y_k - p_j) + \varepsilon_{jk};\ \forall j \in C \tag{6}$$

2.3.2 The econometric model

In this study, the survey respondents choose whether to participate in the conservation program or not (equations 1 and 2). To estimate the choice probalities and to understand the factors that determine the choice behavior, the discrete choice models may be used. In the conceptual basis of the discrete choice models, the chosen option may be denoted as an discrete outcome variable *y*. The models assume that the participant's choice is affected by various factors, of which only some are observable

by the researcher. The observed factors are denoted as *x,* the unobserved factors are denoted as *ε*, and the density of the unobserved factors is denoted as *f.* A function *y=h(x,ε)* refers to a behavioral process, explaining how respondent's choice is related to the observed and unobserved factors. (Train, 2009, p.3-5.)

Although the respondent's choice is not fully predictable and deterministic, the probability *P* of certain outcome may be derived. The responden't probability to choose a certain oucome is the probability that "the unobserved factors are such that the behavioral process results in that outcome", denoted as:

$$P(y|x) = P(\varepsilon \ \ s.t. \ h(x,\varepsilon) = y) \tag{7}$$

The probability may be defined also through an indecator function *I[h(x, ε)=y].* The function takes the value of one if *h(x, ε)=y* is true, meaning that the value of *ε* and *x* cause the respondent to choose the outcome *y*. Correspondingly, the function takes the value of zero if *h(x,ε)=y* is false, meaning that the value of *ε* and *x* cause the respondent to choose other outcome than *y.* Thus, the probability to choose the outcome *y* is "the expected value of the indicator function, where the expectation is over all possible values of the unobserved factors". This may be presented as "an integral of an indicator for the outcome of the behavioral process over all possible values of the unobserved factors":

$$P(y|x) = \int I\,[h(x,\varepsilon) = y] f(\varepsilon) d\varepsilon \tag{8}$$

A binary logit model may be used to evaluate the integral and calculate the choice propability in a case where a respondent considers between two options: whether to participate or not. If the forest owner chooses to participate, negative or positive utility will be obtained. The utility consist of observed part, denoted as *β'x*, and the unobserved part denoted as *ε,* being $U = \beta'x + \varepsilon$. Moreover, *X* refers to a vector of variables and *β* to a vector of parameters. The model excepts that the respondent chooses to participate in the program only if the participation provides net benefit. Therefore, the probability of the forest owner to participate in the program is denoted as:

$$P = \int I\,[\beta' x + \varepsilon > 0] f(\varepsilon) d\varepsilon \tag{9}$$

The model assumes that the unobserved factors ε are distributed logically and the density with cumulative distribution can be denoted as:

$$F(\varepsilon) = \frac{1}{(1+e^{-\varepsilon})} \tag{10}$$

Therefore, for any x, the respondent's probability to choose to participate is:

$$P = \frac{e^{\beta' x}}{(1+e^{\beta' x})} \tag{11}$$

Lastly, The WTA may be calculated through the model estimations, more precisely, from the beta-coefficients by dividing the coefficient of the constant by the coefficient of the payment and multiplying the results by -1.

2.3.3 Identification of protest responses

A well-known challenge in applying SP methods, is that some survey respondents may not reveal their true preferences in their responses, one reason being protest behavior. There can be various type of protest bids such as to not respond, respond positive but invalid bids and to respond zero bids even if the respondent would actual value the good or service. (Halstead et al, 1992.) Recognition of protest responses in the WTA context usually focuses on distinguishing protect respondents from the "very high takers" (VHT) (Ferreira & Gallagher, 2010). VHT refers to respondents whose compensation requirement for participation exceed the highest compensation level presented in the payment vector. Protesters are thought to be outside the market, while VHT are considered to expose their true preferences. Moreover, landowners typically provide ecosystem services and are thus often a focus of studies that investigate the WTA for participating in incentive-based programs. In a theoretical case of a rational behavior, the landowner decides to participate in the program if the estimated benefits exceed the costs. If the landowner decides to choose non-participation in all choice tasks, the responses indicate either protest or very high requirement for compensation. Whether a respondent is a VHT or a protester depends on the reason for non-participation. (Villanueva, Glenk & Rodríguez-Entrena, 2017.) Even it may be challenging to detect and separate the proper responses from protest responses (Meyerhoff, Bartczak & Liebe, 2012; Villanueva et al, 2017), it is important to identify the protest respondents of the survey (Meyerhoff, Mørkbak & Olsen, 2014).

Villanueva et al (2017) recommend identifying and excluding the protest responses from the analysis when estimating the WTA as the inclusion may bias the estimations. The protesters and VHT should be identified by including a follow-up question for the reasons of non-participation. The authors classified the program attribute-related reasons into VHT category. If the respondents justify the choice "not on the basis of their preferences with regards to alternatives, attributes and levels presented in the choice tasks" the respondent is classified as protester. The protest reasons primarily indicate negative attitudes towards the program but include also "no reason" or "no response" responses. Villanueva et al (2017) estimated the WTA for program participation for three samples of all participants, protesters excluding and all serial non-participants excluding, being 69 €/ha, 80 €/ha and 124 €/ha, respectively. The results point that the consideration of serial non-participants may have a major effect on the WTA estimates. The inclusion of VHT may yield in lower estimates of WTA, even the compensation requirement of VHT is actually higher than highest payment offered. Significantly lower WTA may provide wrong signals to decisionmakers if the budgets are set too low. Thus, VHT's should be included and protesters excluded in the WTA estimates.

Finally, the statistical tests for similarities between groups are used when examining the differences between serial non-participants and other non-participants as well as protesters and others than protesters. A chi-squared test (X^2) may be used for categorical variables and Independent Samples t-test for quantitative variables.

3 Survey and data

This section presents the design and implementation of the survey questionnaire, data collection and sample description as well as attitudes and perceptions on statements. The design and implementation of the survey questionnaire include a description of the development process, structure, program attributes and choice tasks. The data collection contains the description of the sample collection method and sample population. Lastly, after the descriptive statistics of the sample, the responses of the attitude statements of the survey questionnaire are presented.

3.1 Design and implementation of the survey questionnaire

The design of a CE survey should follow the best practices and use effective methods in order to ensure the validity and reliability of the estimates of the values (Johnston et al, 2017). Even the development and implementation of a CE survey process is not necessarily straightforward and may need case-by-case consideration, the process can be generalized to include steps as follows. First, the decision problem is characterized considering both the geographical and temporal scope, and the value types that are related to the examined item. Second, the attributes and their levels are to be identified and described in order to select meaningful attributes and reasonable number of levels for the survey respondents. Thereafter, the experimental design is determined, including consideration of the number of choice sets and the number of alternatives in each choice set. The idea is to identify the possible compounds of alternatives, which best identify attribute preferences as well as to form the choice set alternatives to the respondents. Next, the survey questionnaire is developed based on the data collection method, sample and budget, for example. Then, the data is collected using the best survey practices. Once the data has been collected, the estimations of the model are conducted, comprising estimates of individuals' preference parameters. Finally, the interpretation of the results for decision making is carried out. (Holmes et al, 2017, p. 139-143.)

The survey questionnaire design followed carefully the procedure suggested by Holmes et al, (2017). The objective of the survey was to examine the NIPF owners' visions on forestry, forest biodiversity and the role of forests in carbon sequestration and storage, to get view of perceptions of the Finnish NIPF owners. The survey questionnaire was designed between April 2019 and April 2020 based on literature reviews. Additionally, the survey questionnaire was similar to pilot survey, which was conducted earlier in 2019, except for the description of the conservation program. The draft versions

of the survey questionnaire were tested and commented by seven NIPF owners in spring 2020. The tests were made using a think-aloud method, where the participants thought aloud as they were proceeding the survey questionnaire. Based on the interviews, clarifications and modifications on spelling and word choosing were made.

The final survey questionnaire form (in Appendix 1) includes five main sections. The first section includes questions about the respondent's forest property, e.g. the number of forest holdings as well as its location, size, ownership and area. The second section contains questions related to implemented nature and forest management activities, including timber sells. The third section contains the core of the CE survey questionnaire: the choice tasks eliciting the forest owner's preferences for permanent forest conservation program. The fourth section contains questions related to the respondent's perceptions and attitudes on forest management and forest conservation. Finally, the last section includes background questions about the forest owner e.g. the age, occupation, income, gender and residency.

In the section three, before presenting the program and the choice tasks, the features and terms of the program were described. In addition, the voluntary nature of the program was emphasized, as the permanent forest conservation may be a contentious matter. In the conservation program, the forest owner can consider submitting a part or all of the forest property for conservation. The conservation program is permanent, and the agreement binds also the potential future owners. The authorities and the non-profit organization are responsible for the implementation of the program. The payment for the program participation is determined by the quality of the area's biodiversity and the amount of carbon sequestered. Carbon sequestration and biodiversity are assessed using the latest technologies, such as remote sensing. The ownership of the forest area remains for the NIPF owner. However, forestry is not allowed, and firewood cannot be harvested on the area.

The conservation program was described using the program attributes, for which the preferences of forest owners were to be determined. The program attributes were selected based on the relevance in the case of forest conservation in Finland. Interviews, the information on the current PES programs and literature was used to select the attributes and the relevant attribute levels. The attributes are: 1) the eligibility of the forest area, 2) the possibility to conduct non-timber business in the area under permanent conservation, 3) payment for carbon sequestration and 4) payment for biodiversity, presented in table 2. The eligibility of the forest area refers to whether the area is eligible for the

program as it is, or after specific nature management activities performed or commissioned (e.g. enhancing decaying trees or deciduous trees). The respondents were informed that the costs of nature management activities would be compensated. The conduction of non-timber business (e.g. hunting or nature tourism) may be allowed or not allowed, depending on what is recorded in the agreement. However, building permanent facilities in the area would not be allowed. The levels of the lump sum payment for carbon sequestration are specified as 0, 3, 7 or 10% of the amount of payment for biodiversity per hectare, varying between 0 and 1,800 euros. The levels of the lump sum payment for biodiversity vary between 530 and 18,000 euros per hectare, based on the quality of the area's biodiversity (e.g. proportion of deciduous and decaying trees and age of stands). The ranges of carbon and biodiversity payment levels were based on the information on existing protected forest areas, estimated carbon stocks, as well as biodiversity payments based on the value of the forest stand.

Table 2. Program attributes and levels used in the experimental design.

Attributes	Attribute levels
Eligibility of the forest area (ELIGIBIL)	0 = Suitable 1 = Suitable after nature management
Conduction of non-timber businesses (NONTBUSI)	0 = Allowed 1 = Not allowed
Payment for carbon sequestration (CPAYM)	0% of biodiversity payment 3% of biodiversity payment 7% of biodiversity payment 10% of biodiversity payment
Payment for biodiversity (BDPAYM)	530 €/ha 720 €/ha 1,100 €/ha 2,300 €/ha 3,700 €/ha 5,200 €/ha 6,800 €/ha 9,700 €/ha 13,500 €/ha 15,100 €/ha 16,500 €/ha 18,000 €/ha

The attributes and attribute levels generated 176 alternative combinations of programs. The fractional factorial design was created using the Ngene software. The experimental design includes 24 choice scenarios, which were divided into four blocks. Each respondent was asked to conduct six individual choice tasks, in which, they assessed one program at a time. The respondents were instructed to consider the programs separately, not to compare them with each other. As represented in Figure 3, the respondents were asked to state the program attribute that increases most the attractiveness of the program, and the program attribute that increases least the attractiveness of the program, followed by the participation question with answer options "Yes" and "No". If the respondent chose the latter, i.e., the opt-out option at least once in a series of choice tasks, the follow-up question "why would you not participate in the program" was followed.

Please choose the attribute that increases the most and least the attractiveness of the program.

	Forest area suitable	Conducting non-timber business allowed	Payment for carbon 120 €/ha	Payment for biodiversity 530 €/ha
Increases attractiveness the most				
Increases attractiveness the least				

Would you participate in this program if it was available to your forest holding?
Yes
No

Figure 3. An example of the program presented in the survey questionnaire.

3.2 Data collection

In total, 5,010 NIPF owners were invited to take part on the online survey questionnaire, undertaken by a professional polling company IROResearch in May 2020. The survey invitations were sent by e-mail to 1,527 forest owners (covering 30% of the invites) and by mail to 3,483 forest owners (covering 70% of the invites) because their email addresses were not available. The target population sample was all the Finnish NIPF owners who own at least 5 hectares of forestland in Finland with the exception of Åland Islands. The forest owners were randomly sampled from the register of the Finnish Forest Centre, stratified for the location of the forest in 18 counties in Finland. All counties except Åland islands were included, however, several forest owners residing in the Åland Islands appeared in the sample. The population sample consist of the relative amounts of forest owners from each county as follows: Approximately 7.3% from Central Finland; 2.1% from Central

Ostrobothnia; 4.6% from Kainuu; 2.8% from Kymenlaakso; 9.7% from Lapland; 6.5% from North Karelia; 12.4% from Northern Ostrobothnia; 7.7% from Northern Savonia; 4.6% from Ostrobothania; 2.4% Paijänne Tavastia; 6.3% from Pirkanmaa; 4.1% from Satakunta; 3.2% from South Karelia; 7.3% from Southern Ostrobothnia; 7.1% from Southern Savonia; 5.5% from Southwest Finland; 2.4% from Tavastia Proper and 3.9% from Uusimaa. The NIPF owners who own forests in several counties were in the sampling based in the county in which most of the forest land is located. Further, the residence of the forest owner may be in different municipality than the forest is located.

Out of the total number of sent survey invitations, 587 survey questionnairs were returned after three reminders. Thereby, the overall response rate was 11.7%. Of the 587 respondents, 57% fully completed the survey and 43% partially completed the survey. Of the 250 partially completed survey respondents, 16% dropped out in the first part of the survey; 12% in the second part; 71% in the third part containing e.g. the choice tasks; none in the fourth part and less than 1% dropped out in the fifth part. Out of the 378 respondents starting the set of six choice tasks, 33 dropped out during the choice tasks. Nine of them dropped out after completing one choice task; seven after two tasks; six after three tasks; three after four tasks and eight after completing five out of six choice tasks, remaining 345 respondents that completed all the six choice tasks.

3.3 Sample description

According to the descriptive statistics of the socio-economic characteristics of the sample (Table 3 and Appendix 2), the average age is 59 years and the average household size is 2.3. Almost one third (29%) are female; every fourth (26%) have at least a Master's degree; more than one-third (39%) are pensioner and half (51%) live in rural or sparsely populated areas. Slightly less than one third (28%) have a permanent residency on the forest holding and 41% has no related residence on the forest holding. More than one-fourth (28%) are hunting club members; as many as 60% are land renters of hunting clubs; only 8% are members of conservation organizations; 13% have a protected forest site; yet only every fourth (23%) first heard about the METSO Programme in the survey. Moreover, according to the descriptive statistics of the characteristics of the forest property of the sample (Appendix 3), an average forest owner owns 86 hectares of forest, has owned the forest holding since 2001 and the size of the largest forest holding is 52 hectares. Further, half (49%) own only one forest holding, and three out of four (74%) owns the forest by oneself or with a spouse. Approximately 41% have inherited or received the forest as a gift and 21% have purchased the forest from the markets.

Household's annual forest income share of total income is less than 5% for slightly more than half (52%) of the respondents. Further, more than two-thirds (69%) have a forest management plan and almost every fourth (24%) has implemented nature management in commercial forests. Furthermore, even 90% have sold timber, pulpwood or fuelwood during 2017-2019, yet only 7% sell timber every year.

Table 3. Descriptive statistics of the selected sample compared with the Finnish forest owner 2020.

	Survey respondents Sample average	Finnish forest owner 2020 Sample average
Age	59	62 (N=6,395)
Female	29 %	25% (N=6,302)
Permanent residency on the forest holding	28 %	35% (N=6,386)
Occupation group		
Employees	43 %	37% (N=6,471)
Full time farmer / forestry enterpreneurs	7 %	9% (N=6,471)
Other enterpreuners	7 %	6% (N=6,471)
Pensioners	39 %	47% (N=6,471)
Living environment		
Urban	49 %	47% (N=6,366)
Rural / sparsely populated	51 %	53% (N=6,366)
Ownership of the forest holding		
Family ownership	74 %	72% (N=6,383)
Consortium	19 %	17% (N=6,383)
Estate	6 %	11% (N=6,383)
Way to get / purchase the forest holding		
Heritage or gift	41 %	53% (N=6,541)
Purchase from parents or relatives	36 %	28% (N=6,542)
Purchase from the markets	21 %	12% (N=6,543)
Ownership in years	20	22 (N=6,189)

Table 3 compares the selected descriptive statistics of the sample with the descriptive statistics of "The Finnish forest owner 2020". Some of the statistics were not directly comparable e.g. the education because some of the classes crossed, as well as the household's annual net income because timber sales revenues were not included in the other study and were therefore not compared. The largest difference between the descriptive statistics of the studies is the share of the forest owners who inherited or received the forest as a gift (41% vs. 53%). However, the sample of the survey is reasonable representative for the population.

3.4 Attitudes and perceptions on statement

The survey questionnaire includes questions that aim to explore the respondents' attitudes and perceptions. One of the attitudinal questions examined opinions on the importance of the economic, social, environmental and leisure time aspects on forest holding (Appendix 4). The most important aspect was forestry work and/or wood for household use as 69% of the respondent considered it important. Biodiversity conservation was the second most important factor as 64% considered it important followed by relaxation, which was considered important by 61% of the respondents. On contrary, the least important aspect, stated by over three-fourth (77%), was the importance of other business activities, followed by hunting and income from work, both stated by over half (55%) of the respondents. The question about the importance of climate change mitigation gave the highest share of unsure-type responses as almost one-third (31%) stated the in between or cannot say answer.

Additionally, perceptions on the statements in terms of respondents' own forest management and forest property were asked (Appendix 5). The most agreed statements, agreed by 87% of the respondents, was the duty to protect the nature and the importance of forestry in climate change mitigation followed by the statement of aesthetic experience from forest, agreed by 85% of the respondents. Even 83% of the respondents were concerned that climate change could significantly increase the risk of forest damage. By far the least agreed statement, disagreed by 72% of respondents, was the "I am not interested in protecting biodiversity in my forest". Almost half (46%) indicated unsure respondent on the statement "I am interested in participating in carbon trade".

Regarding the importance of factors for the sustainability of Finnish forestry of the respondents (Appendix 6), more than four-fifths (84%) consider important the use of by-products of forest industry for biofuels. The least important factor, considered not important by more than one-third (40%), was that the cuttings are decreased to mitigate climate change. Interestingly, the statement "timber cuttings are decreased to protect biodiversity" distributed the responses the most, as approximately every third consider it important (32%), every third not important (34%) and every third neither (23%).

4 Results

The rich set of variables in the survey questionnaire enabled the investigation of various socio-economic and attitudinal factors that affect the preferences and program participation decision. First, the reasons for not to participate in forest conservation programs are analysed, including the characterization of serial non-participants and protesters. Then, the estimations of the WTA compensation are considered, followed by the examination of preference heterogeneity regarding two program attributes. The statistical analyses are conducted using the IBM SPSS Statistics version 25 and Microsoft Excel. The binary logit model is used when estimating the model results, using the Nlogit Software 6.0.

4.1 Reasons for not to participate in forest conservation program

The responses to six choice tasks on the program participation were examined to identify the non-participants. In total, 2,164 responses to the choice tasks were included in the analysis. Regarding the respondents who completed all six choice tasks, 28 chose to participate in 1 out of 6 choice tasks; 19 in 2 choice tasks; 47 in 3 choice tasks; 26 in 4 choice tasks; 19 in 5 choice tasks and 60 respondents chose to participate in the program in 6 out of 6 choice tasks. Of the respondents, 285 chose not to participate at least once in the choice tasks and are from now own called non-participants.

Table 4. Reasons for non-participation and their frequencies

Name	Why would you not participate in the program?	Freq.	%
WHYECON	1. The offered compensation is not sufficient in relation to the economic value of my forest	118	24 %
WHYECOL	2. The offered compensation is not sufficient in relation to the ecological value of my forest	47	10 %
WHYBIND	3. I do not want to bind my forest to a permanent conservation program	139	29 %
WHYNOBD	4. There are no suitable biodiversity features in my forest	59	12 %
WHYPROG	5. I do not need official programs to protect my forest	90	19 %
WHYNOT	6. I am not interested in forest protection	8	2 %
WHY2CONT	7. Dissatisfied with the elements of the program agreement	5	1 %
WHY2DECIS	8. Need more information / Cannot make a decision	10	2 %
WHY2DIST	9. Distrust	6	1 %
WHY2ELSE	10. Other uses planned for the forest area	2	0 %
	Total	484	100 %

After a series of choice tasks, a follow-up question “Why would you not participate in the program?” identified the reasons for non-participation (Table 4). The respondents were allowed to select multiple reasons for non-participation (items 1-6) and additionally to specify other reasons, leading in total 484 reasons for non-participation. Of the 285 non-participants, 48% stated a single reason for non-participation; 31% stated two reasons; 13% three reasons; 4% four reasons and 1% stated five reasons.

Eight respondents (3%) did not select any reason and quit the survey at this point. Altogether, 453 reasons for non-participation were based on items 1-6 and 31 other reasons were expressed, combined and modified as items 7-10. The other reasons were "Dissatisfied with the elements of the program", such as *"the collection of firewood is prohibited";* "Need more information/Cannot make a decision", such as *"I cannot decide on forest matters alone*"; "Distrust", such as *"the forest conservation program is irrational*"; and "Other uses planned for the forest area" such as hunting. Three major reasons for non-participation were the binding nature of the permanent conservation program (WHYBIND, 29% of the responses), the inadequacy of the compensation in relation to the economic value of the forest (WHYECON, 24% of the responses) and the lack of need for an official conservation program for forest protection (WHYPROG, 19% of the responses).

Characterization of serial non-participants

Out of the 285 non-participants, half (49%) were serial non-participants, who chose to not participate in all six choice tasks. Out of the serial non-participants, 47% stated a single reason for non-participation; 30% stated two reasons; 13% three reasons; 4% four reasons; 1% five reasons and 5% did not give any reason and quit the survey. In total, 139 serial non-participants expressed 247 reasons for non-participation. The main reasons for non-participation (38% of the responses) was the binding nature of the permanent forest conservation program and the unnecessary nature of the official conservation program for forest protection (26% of the responses).

The reasons for non-participation vary between serial non-participants and other non-participants (Figure 8). According to the statistical tests, serial non-participants and other non-participants differ statistically significantly in four respects. Serial non-participants are statistically significantly (p-value 0,000) more likely to choose, as a reason for non-participation, the binding nature of the program (WHYBIND) and the perceived lack of need for an official program (WHYPROG). Further, serial non-participants are statistically significantly (p-value 0,000) less likely to choose the inadequacy of the compensation in relation to the economic value of the forest (WHYECON) and the inadequacy of the compensation in relation to the ecological value of the forest (WHYECOL) as a reason for non-participation.

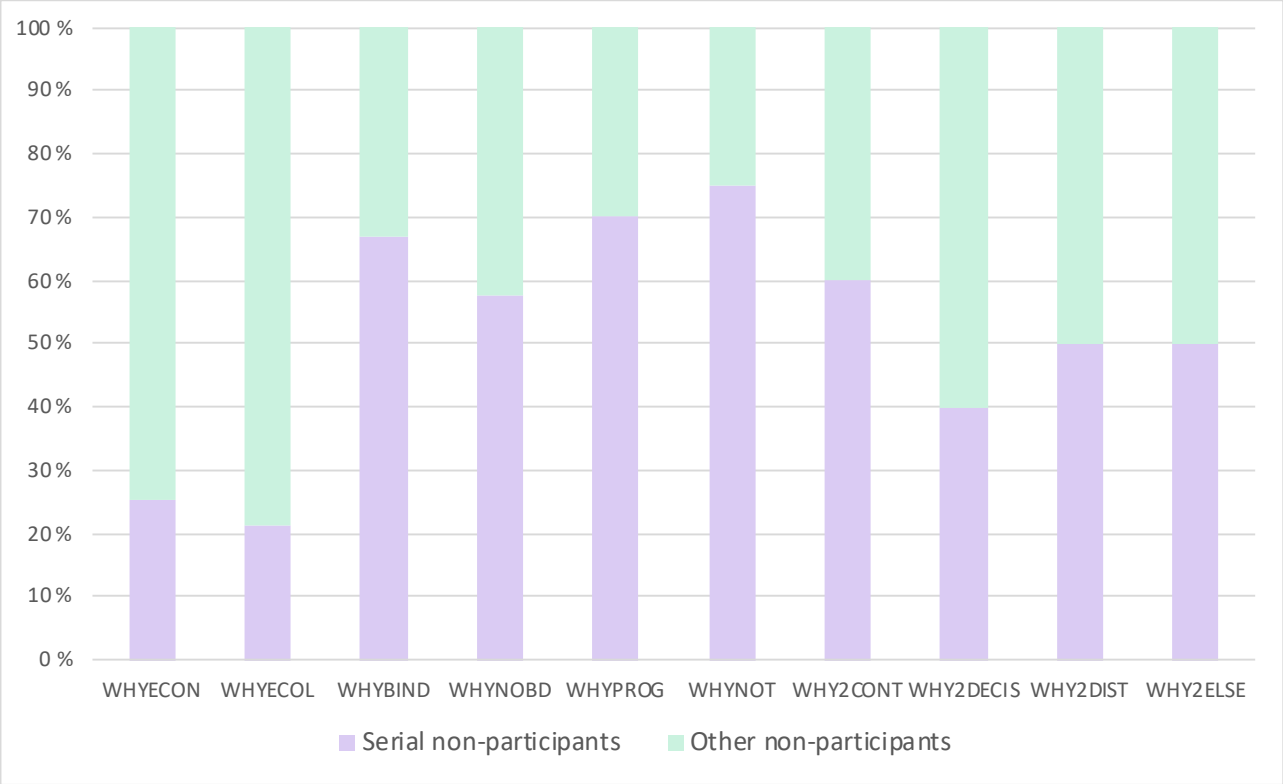


Figure 8. Non-participation reasons of serial non-participants and other non-participants.

According to the statistical tests (Appendix 7), a serial non-participant is statistically significantly, compared to other non-participants, less likely a male (61% vs. 76%), lives more likely abroad (2% vs. 0%), have less likely a 10-year METSO forest site (2% vs. 8%) and have more likely first heard about the METSO Programme in the survey (25% vs. 16%). Education, income, occupation group, age, size of forest property and forest income, to mention, do not statistically significantly differ between the groups.

Regarding attitudinal aspects, a serial non-participant is less likely to consider important the implementation of climate change mitigation (39% vs. 55%), biodiversity conservation (57% vs. 74%) and water system conservation (49% vs. 66%) on their forest holding. In addition, a serial non-participant is less likely to consider decreased cuttings to protect biodiversity important for the sustainability of Finnish forestry (24% vs. 38%). Further, serial non-participants are less likely agreeing with the following statements concerning their forest management and forest property: “I need more information about the features of my forest to consider joining the conservation program” (32% vs. 65%), “Instead of a lump sum, I would prefer an annual payment for the program” (45% vs. 65%), “Carbon offsetting is the climate policy of the future” (49% vs. 65%), “Old forests must be preserved for future generations” (66% vs. 84%), “Increasing deforestation impairs the conservation of biodiversity” (37% vs. 50%), “I am proud to know that my forest provides benefits to society in

addition to my own benefits" (56% vs. 75%), "I understand the importance of forestry in climate change mitigation" (82% vs. 90%), "My family tends to leave part of the forest out of timber production" (41% vs. 60%), "Simultaneous protection of forest biodiversity and carbon storage is possible on my forest holding" (62% vs. 76%), "I would rather sell my forest property to a nature conservation organization than to any other private buyer" (10% vs. 24%), "I am interested in participating in the carbon trade" (16% vs. 51%), "I have a duty to protect nature" (81% vs. 92%) and "I am interested in active nature management that promotes biodiversity" (53% vs. 80%). Finally, serial non-participants are more likely agreeing with the statements "I am not interested in protecting biodiversity in my forest" (19% vs. 9%) and "I do not support the idea of restrictions on forest management" (64% vs. 52%).

Characterization of protesters

The reasons of non-participation of serial non-participants were examined to identify VHT (very high takers) and protesters before modelling the participation choices, following the recommendation for distribution by Villanueva et al (2017). The program attribute related reasons are classified to "very high taker" category and the not program alternatives or attribute related reasons are classified to protest category, presented accordingly in Table 5.

Table 5. Classification of reasons for serial non-participation

Name	Why would you not participate in the program?	Classification
WHYECON	The offered compensation is not sufficient in relation to the economic value of my forest	Very high taker
WHYECOL	The offered compensation is not sufficient in relation to the ecological value of my forest	Very high taker
WHYBIND	I do not want to bind my forest to a permanent conservation program	Protest
WHYNOBD	There are no suitable biodiversity features in my forest	Protest
WHYPROG	I do not need official programs to protect my forest	Protest
WHYNOT	I am not interested in forest protection	Protest
WHY2CONT	Dissatisfied with the elements of the program agreement	Protest
WHY2DECIS	Need more information / Cannot make a decision	Protest
WHY2DIST	Distrust	Protest
WHY2ELSE	Other uses planned for the forest area	Protest

Among the reasons for non-participation of serial non-participants, 16% are categorized to a VHT and 84% to a protest category. Based on these results, 6% of the serial non-participants are classified as VHT, 77% as protesters and 17% as both VHT and protesters. The ones classified into both VHT and protester category are assigned into the VHT category, because these respondents had justified

their choices "on the basis of their preferences with regards to alternatives, attributes and levels". Thus, of the 139 serial non-participants, 23% are "very high takers" and 77% protesters.

According to the statistical tests (Appendix 8), many of the socio-economic and attitudinal characteristics, which were included in the analysis, are not statistically significant and therefore affect protest behavior. However, also several statistically significant characteristics were found to affect protest behavior. A protester is statistically significantly, in comparison to other serial non-participants, more likely a pensioner (45% vs. 32%), female (77% vs. 58%), a renter for hunting club (69% vs. 57%) and has a higher average age (61 vs. 57 years). A protester is less likely a contact customer of a forest company (13% vs. 26%), have less likely annual forest income share of total income more than 26% (4% vs. 17%) and has a 10-year METSO forest site (1% vs. 7%). Further, a protester is less likely to consider important the income from work in own forest (16% vs. 30%), climate change mitigation (38% vs. 51%) and water system conservation (49% vs. 62%) on their forest holding.

Moreover, protesters are less likely agreeing with the following statements related to the forest: "I want to get more information about the natural values of my forest" (36% vs. 51%), "My family tends to leave part of the forest out of timber production" (38% vs. 56%), "Simultaneous protection of forest biodiversity and carbon storage is possible on my forest holding" (62% vs. 73%), "I am interested in participating in the carbon trade" (12% vs. 42%), "I am interested in active nature management that promotes biodiversity" (54% vs. 73%). Additionally, protesters are more likely agreeing with the statements "I need more information about the features of my forest to consider joining the conservation program" (71% vs. 45%), "Instead of a lump sum, I would prefer an annual payment for the program" (63% vs. 37%), "I am proud to know that my forest provides benefits to society in addition to my own benefits" (45% vs. 30%), "I am not interested in protecting biodiversity in my forest" (20% vs. 10%).

4.2 Estimation of the WTA compensation

The binary logit models, with and without protesters, were estimated to form the base for the further analysis and to estimate the respondents' WTA compensation for program participation. The model includes the program attributes, which are the eligibility of the forest area (ELIGIBIL), conduction of non-timber businesses (NONTBUSI) and payments. Payments for carbon sequestration and biodiversity are combined into one variable in the model, (CANDBDPM) as the payment would be

one in real life. The CANDBDPM levels were scaled by dividing them by 1000 in order to review the results more easily and to allow the similar scales of the attributes. The aim of the base models is to find out how the attributes affect the choice with different type of respondents and how the exclusion of protesters affects the results (Table 6).

Table 6. Estimated base models with all respondents and without protesters

	Model 1: All respondents included		Model 2: Protesters excluded	
Variable	Coefficient (β)	Standard error (SE)	Coefficient (β)	Standard error (SE)
Constant	-1.058***	0.089	-0.498***	0.111
ELIGIBIL	-0.073	0.096	-0.067	0.123
NONTBUSI	0.073	0.099	0.080	0.126
CANDBDTH	0.066***	0.007	0.088***	0.009
WTA (€/ha)	16,032		5,641	
Log likelihood function	-1367.562		-836.591	
Restricted log likelihood	-1421.834		-893.659	
McFadden pseudo R^2	0.038		0.064	
N	2164		1294	
Significance level 1%***, 5%**, 10%**				
Notes: ELIGIBIL = Eligibility of the forest area (suitable after nature management) NONTBUSI = Conduction of non-timber businesses (not allowed) CANDBDTH = Payment for carbon sequestration and biodiversity				

The coefficient refers to the estimated parameter, which is used to calculate the derived utility from a change in the variable. The larger the coefficient, the greater is the effect of the attribute. The derived utility increases as the level of the attribute increases, if the coefficient is positive. Correspondingly, the derived utility decreases as the level of the attribute increases, if the coefficient is negative. The coefficient of the constant captures the variation in preferences that cannot be explained by the attributes. If the constant is positive, the respondents are willing to participate in the program on average. Correspondingly, if the constant is negative, the respondents are not willing to participate in the program on average. Moreover, standard error refers to the standard deviation of the sampling distribution of the parameter. P-value refers to the risk level at which the hypothesis that the attribute does not affect the choice can be rejected. The McFadden pseudo R^2 refers to how much the model is able to explain the choice behaviour. The larger the R^2 value, the better. The stars in the table refer to the statistical significance level of an attribute in the model.

According to the estimated results of the models 1 and 2, the payment and constant are statistically significant factors, i.e. non-timber business and eligibility of the forest area do not affect the decision to participate in the program. The coefficients of the constant in both models are negative, indicating that the respondents are not willing to participate in the program on average. Further, the coefficient of the payment is positive, as expected based on economic theory and previous studies: the higher level of payment increases the probability to choose to participate in the program. The coefficient of the payment is higher when protesters are excluded from the model (0.088 vs. 0.066), expressing that the effect of the payment is slightly higher when protesters are excluded. Further, as implied by an increase in the explanator parameter of the model (R^2), the model without the protesters explains the choices better. Finally, the estimated WTA compensation, at the program level, for the program participation is 16,032 euros per hectare when the protesters are included in the analysis (Model 1). Respectively, the estimated WTA is 5,641 euros per hectare when the protesters are excluded from the analysis (Model 2). All further analyses are built on Model 2, where protesters are excluded, as the results may be expected to be more realistic, as explained in Section 3.

4.3 Preferences for program attributes

The sources behind preference heterogeneity regarding the attributes of eligibility of the forest area (ELIGIBIL) and conduction of non-timber businesses (NONTBUSI) were examined by exploring systematically the potential explanatory variables. Interactions with the ELIGIBIL and NONTBUSI attributes were created and added to the model, one at a time, in order to examine whether the interaction with the attribute made either of the attribute statistically significant. The models that included all the interactions that made either of the attribute statistically significant were run.

The impact of attitudes

Of the attitudinal interaction variables that were formed from the attitudinal questions (Appendix 4-6) and were inserted one by one into the binary logit model, 32 affected statistically significantly the preference for the attribute. When those 32 interactions were inserted into the model together, seven interactions remained statistically significant and were included into a next model. Then, two out of seven interactions, that were not statistically significant, were removed from the final version of the model. Table 7 presents the statistically significant interactions in the attitudinal model and their mean values in the sample, when protesters are excluded.

Table 7. The attitudinal variables in the model and the mean values in the sample.

Interaction	Name	Definition	Mean value
IMPBERRY * ELIGIBIL	7_5*EL	Berry and/or mushroom picking at the forest holding (1=Very important, 2,…,5=Not important at all, 6=I cannot say)	2.76
COMMODIT * ELIGIBILITY	36_9*EL	I do not want to think of natural resources as a market commodity (1=Totally agree, 2=Partly agree, 3=Neither agree nor disagree, 4=Partly disagree, 5=Totally disagree, 6=I cannot say)	3.44
ORGANIZA * NONTBUSI	37_6*NT	I would rather sell my forest property to a nature conservation organization than to any other private buyer (1=Totally agree, 2=Partly agree, 3=Neither agree nor disagree, 4=Partly disagree, 5=Totally disagree, 6=I cannot say)	3.81
CONSVALU * ELIGIBILITY	37_8*EL	The conservation values of my forest depend on how the forest is managed on neighbor forest holdings (1=Totally agree, 2=Partly agree, 3=Neither agree nor disagree, 4=Partly disagree, 5=Totally disagree, 6=I cannot say)	3.59
FAMILY * ELIGIBILITY	37_10*EL	My family and / or loved ones think that forest protection is a good deed (1=Totally agree, 2=Partly agree, 3=Neither agree nor disagree, 4=Partly disagree, 5=Totally disagree, 6=I cannot say)	2.15

According to the attitudinal model estimates (Table 8), the significance of the coefficients of the attributes and attitudinal interaction variables indicates that the attributes statistically significantly affect the participation choice and the certain attitudes of respondents explain the heterogeneity of the attribute preferences. The program attributes of eligibility of the forest area, conduction of non-timber business and the payment are statistically significant factors, i.e. all program attributes affect the decision to participate in the program. The coefficient of the constant is positive, indicating that the respondents are willing to participate in the program on average. The coefficient of the payment is positive i.e. the higher level of payment increases the probability to choose to participate in the program. Further, the coefficient of the eligibility of the forest area is negative i.e. the required nature management decreases the probability to choose to participate in the program. Furthermore, the coefficient of the conduction of non-timber business is also negative i.e. the forbidden non-timber business activities decreases the probability to choose to participate in the program.

Table 8. Estimated binary logit model with attitudinal characteristics.

Variable	Coefficient (β)	Standard error (SE)
Constant	0.329*	0.169
ELIGIBIL	-1.720***	0.570
NONTBUSI	-1.183***	0.435
CANDBDTH	0.049***	0.015
7_5*EL	-0.395***	0.123
36_9*EL	0.343***	0.118
37_6*NT	0.362***	0.118
37_8*EL	0.398***	0.111
37_10*EL	0.404**	0.171
Log likelihood function	-329.775	
Restricted log likelihood	-373.374	
McFadden pseudo R^2	0.117	
N	603	
Significance level 1%***, 5%**, 10%*		
Notes: ELIGIBIL = Eligibility of the forest area (suitable after nature management) NONTBUSI = Conduction of non-timber businesses (not allowed) CANDBDTH = Payment for carbon sequestration and biodiversity		

The positive coefficient of the interaction variable 37_6*NT indicate that a weaker preference for forbidden conduction of non-timber businesses is explained by stronger disagreement, than on average, on the attitudinal question "I would rather sell my forest property to a nature conservation organization than to any other private buyer". In other words, the weaker preference on the attribute NONTBUSI is explained by disagreeing to the statement stronger than average mean value 3.81. Further, the positive coefficients of the interaction variables 36_9*EL, 37_8*EL and 37_10*EL indicate that weaker preference for required nature management activities is explained by a higher disagreement, than on average, on the attitudinal questions "I do not want to think of natural resources as a market commodity"; "The conservation values of my forest depend on how the forest is managed on neighbour forest holdings"; and "My family and / or loved ones think that forest protection is a good deed". In other words, the weaker preference on the attribute ELIGIBIL is explained by disagreeing to the statements stronger than average mean values 3.44, 3.59 and 2.15, respectively. Further, the negative coefficient of the interaction variable 7_5*EL indicate that stronger preference for required nature management activities is explained by a stronger unimportance, than on average, on the attitudinal question: "How important is berry and/or mushroom picking to you on your forest

holding". In other words, the stronger preference on the attribute ELIGIBIL is explained by stronger unimportance on the statement, than average mean value 2.15.

The impact of socio-economic aspects

To examine the effect of the socio-economic variables on the attribute preferences, the socio-economic interaction variables were inserted one by one into the binary logit model. Out of these, 21 statistically significant socio-economic interactions were included into the model at the same time. Table 9 presents the three socio-economic variables of respondents that remain statistically significant, and their mean values in the sample, when the protesters were excluded.

Table 9. The socio-economic variables in the model and their mean values in the sample.

Interactions	Name	Definition	Mean value
CONSERVA * ELIGIBILITY	42_5*EL	A member of a conservation organization (1=Yes, 0=No)	0.08
GENDER * ELIGIBILITY	DUM46*EL	Gender (1=Male, 0=Other)	0.40
SITUATIO * ELIGIBILITY	DUM52*EL	Occupational group or situation (1=Pensioner, 0=Other)	0.22

According to the socio-economic model estimates (Table 10), the significance of the coefficients of the eligibility of the forest area (ELIGIBIL) and the attitudinal interaction variables with ELIGIBIL indicate that the attribute statistically significantly affect the participation choice and the respondent's socio-economic characteristics explain the heterogeneity of the attribute preferences. However, the attribute of conduction of non-timber businesses (NONTBUSI) is not statistically significant, indicating that the attribute does not affect the participation choice and the respondent's socio-economic characteristics do not explain the attribute preferences of NONTBUSI.

Table 10. Estimated binary logit model with socio-economic characteristics.

Variable	Coefficient (β)	Standard error (SE)
Constant	0.355**	0.165
ELIGIBIL	1.202***	0.372
NONTBUSI	-0.002	0.200
CANDBDTH	0.045***	0.142
42_5*EL	-1.712***	0.489
DUM46*EL	-0.692*	0.361
DUM52*EL	-0.486*	0.274
Log likelihood function	-357.600	
Restricted log likelihood	-373.374	
McFadden pseudo R^2	0.042	
N	603	
Significance level 1%***, 5%**, 10%*		
Notes: ELIGIBIL = Eligibility of the forest area (suitable after nature management) NONTBUSI = Conduction of non-timber businesses (not allowed) CANDBDTH = Payment for carbon sequestration and biodiversity		

According to the estimated results of the socio-economic model, the program attributes of eligibility of the forest area and the payment are statistically significant, i.e. the conduction of non-timber business does not affect the decision to participate in the program. The coefficient of the constant is positive, indicating that the respondents are willing to participate in the program on average. The coefficient of the payment is positive i.e. the higher level of payment increases the probability to choose to participate in the program. The coefficient of the eligibility of the forest area is positive i.e. the required nature management increases the probability to choose to participate in the program. Further, the coefficients of the socio-economic interaction variables indicate that weaker preference, than on average, for required nature management activities (vs. forest area is eligible for the program as it is), is explained by respondent's membership in a conservation organization, male gender and a pensioner situation.

5 Discussion and conclusion

This study provides information on the Finnish NIPF owners' participation behavior in a novel, permanent, forest conservation program for carbon sequestration and biodiversity, by using a survey questionnaire. Particularly, the study analyses protesters and attribute preferences as well as estimates of the WTA compensation. The results show that a great majority (77%) of serial non-participants are protesters and the protest behavior is determined by a plenty of specific socio-economic and attitudinal factors. According the results of the comparison of the WTA estimates for program participation, the assumption that the inclusion of protesters may result higher compensation requirement is confirmed. When the protesters are included, the estimated WTA is considerably higher than when the protesters are excluded being 16,032 €/ha and 5,641 €/ha, respectively. The results of the analysis of the preferences reveal attitudinal and socio-economic aspects affecting program attribute of the eligibility of forest area. Moreover, according to the analyses of the preferences of the conduction of non-timber businesses in this study, the possibility to conduct non-timber businesses is rather irrelevant for the respondents. Besides a few attitudinal factors that influence the preferences of the attribute statistically significantly, none of the socio-economic factors statistically significantly influence the preferences of the attribute. Further, by far the least important attitudinal aspect from the economic, social, environmental and leisure time factors on forest holding was the implementation of other business activities on the forest holding, stated important by only 8% of the respondents.

To our knowledge, this study is the first that aim to explain the sources of protest behaviour in the context of permanent forest conservation programs. For instance, Meyerhoff & Liebe (2010) conducted a meta-study investigating survey characteristics that impact protest behaviour. In addition, Meyerhoff et al (2014) conducted a meta-study focusing on both individual and survey characteristics impacting protest behavior. However, both of the studies were conducted in the WTP context and therefore did not examine the WTA of PES program providers. Horne (2006) estimated an annual WTA to be 224 €/ha when including all respondents in the welfare analysis. When the serial non-participants were excluded, the WTA estimate was -62 €/ha, meaning that the welfare impact was positive i.e. forest owners would theoretically participate in the conservation program even without financial compensation. Robatyagov and Lin (2013) estimated the WTA separately for the different levels of the contract duration and found heterogeneity between the WTAs. The

estimated annual WTA was $103 per acre for a 30-year contract; $149 per acre for a 50-year contract and $169 per acre for the permanent conservation contract.

Similar PES program attributes for forest management requirements have been studied at least by Dickinson et al (2012) and Robotyagov & Lin (2013). Dickinson et al (2012) investigated the program attribute where the forest management plan was either required or not required. The results indicate that the landowners are less likely to participate in a program that requires a management plan. Robotyagov and Lin (2013) investigated the program attribute in which the biodiversity-enhancing management was either required or not required. The results indicate that the landowners' preference for the management requirement depends on past harvesting behavior and on ownership objectives. The landowners who stated the ecological objectives as very important were more likely to have a positive preference over forest management requirements. Moreover, as reviewed in the literature review, Horne (2006) studied certain restrictions on forest use that were "small patches protected", "nature management plan", "no silvicultural practices" or "strict nature reserve". Kang et al (2019) examined certain restriction on forest use of "increased plantation size not allowed" or "no restrictions". Yet, to our knowledge, no other study has investigated forbidden conduction of non-timber businesses as a restriction on forest use in forest conservation PES program.

The survey questionnaire was targeted to 5,010 NIPF owners across the counties, nonetheless, the overall response rate (11.7%) was rather low. The representativeness of the sample to Finnish population was not tested with statistical tests and may affect the generalization of the results. Methodologically, reporting two different WTAs for program participation demonstrates properly the significance of the protest identification for the results, and indicate that the WTA estimates without protesters are recommended to be used. However, the WTA estimates cannot be taken from this context, as the WTAs are based on the average and the estimates are not based on the forest sites nor the quality of the forest sites. The WTA estimate without protesters (5,641 €/ha) is surprisingly close to the average compensation for conservation of the METSO Programme, which is 4,571 €/ha (Ministry of the Environment of Finland, 2019). Contradictorily, the findings of WTA estimates with and without protesters do not correspond with previous research. The differences may be explained at least by the different payment type, what is paid for and may also be explained by the consideration of protest responses. Firstly, the payment type of most of the previous studies has been annual payment whereas this study used a lump sum payment type. Secondly, there is no other similar study where the biodiversity payment has been combined with the carbon sequestration payment. The

payments for carbon sequestration and biodiversity were compounded into one variable (CANDBDPM) when modelling the decision of the forest owners. This implies that the impact of the particular reason of payment (carbon sequestration or biodiversity) for the willingness to participate was not examined. The decision to combine the payment variable was justified by a single amount of compensation in real life, however, the separation of the payments could potentially make a significant difference if it improves the willingness to participate at a certain payment level. Lastly, this is the first study aiming to explain the protest behaviour in the context of permanent forest conservation program. Nonetheless, it is unclear whether the protesters are protesting against the survey or against the voluntary conservation itself. If the protesters protest against the survey, it may be important to understand the protest behavior from the methodological point of view. However, if the protesters are indeed protesting against the voluntary conservation (and would not agree on the protection even if the payment was genuine), it may be essential to review whether the WTAs of the protesters truly are that high from a welfare analysis point of view. If the protesters protest against the voluntary conservation program, further research would be important, for example, on the NIPF owners' behavior on a reverse auction in which the aim would be to generate the lowest possible WTA for program participation.

The results of this study support the findings of previous studies, yet, provide novel information on protesters and preferences of certain attributes of forest management requirements and conduction of non-timber businesses. The results may be useful when developing and targeting voluntary forest policy incentives for the NIPF owners. However, the results do not reveal whether the METSO Programme should be offered specifically as a biodiversity or climate change mitigation program for its acceptability. Information on the NIPF owners' characteristics, attitudes and impact on the behavior may be used in the policy design and implementation as well as in the business development of the organizations that provide services for the NIPF owners. Although the results of protest behaviour of this study are difficult to assess and compare, due to the lack of previous studies, the results may help recognizing protesters more easily and reduce protest behavior. However, a closer look at the sources of the protesters (survey of conservation program) could be a possible topic for future research. Lastly, further studies on individual attribute level WTA of the particular permanent forest conservation program could be valuable to reveal detailed information of the program attributes.

In conclusion, besides the development of sustainable forest management that diminish and reduce land degradation as well as contribute to climate change mitigation and adaptation, the forest

conservation should be enhanced globally. The inclusion and regulation of the LULUCF sector in the EU's climate targets and the 30% conservation target of land in the EU Biodiversity Directive are putting enormous pressure on the further development of the conservation programs. In Finland, forests are the most important renewable natural resource and forestry is a significant contributor for the national economy. Paradoxically, forests are also the largest carbon sinks of the LULUCF sector and provide remarkable amount of biodiversity. Nationally, the NIPF owners' forests represent 60% of the total area of forest land. If the forests are to be conserved as an important source of biodiversity and carbon sequestration, the conservation programs shall be developed for the NIPF owners. The willingness to provide ecosystem services may be increased in the presence of sufficient monetary compensation, especially if the forest owners' ownership objective is not solely timber production. However, the effectiveness of the conservation program depends on the context and require examination and consideration when designing a conservation program. The decision makers must balance the likelihood of landowners' program participation with the resulting biodiversity and carbon sequestration in the design of the program. If the decision makers aim to maximize the conservation of forest biodiversity and carbon sequestration, the NIPF owners must be involved.

References

Bennett, J., & Blamey, R. (Eds.). (2001). *The choice modelling approach to environmental valuation*. Edward Elgar Publishing.

D'Amato, A. W., Bradford, J. B., Fraver, S., & Palik, B. J. (2011). Forest management for mitigation and adaptation to climate change: insights from long-term silviculture experiments. *Forest Ecology and Management*, *262*(5), 803-816.

Dickinson, B. J., Stevens, T. H., Lindsay, M. M., & Kittredge, D. B. (2012). Estimated participation in US carbon sequestration programs: A study of NIPF landowners in Massachusetts. *Journal of forest economics*, *18*(1), 36-46.

European Commission (2020). EU Biodiversity Strategy for 2030. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/eu-biodiversity-strategy-2030_en

Ferreira, S., & Gallagher, L. (2010). Protest responses and community attitudes toward accepting compensation to host waste disposal infrastructure. Land Use Policy, 27(2), 638-652.

Ficko, A., Lidestav, G., Dhubhain, A. N., Karppinen, H., Zivojinovic, I., & Westin, K. (2017). European private forest owner typologies: A review of methods and use. *Forest Policy and Economics*.

Finnish forest statistics (2018). Natural Resources Institute Finland. Retrieved from https://stat.luke.fi/sites/default/files/suomen_metsatilastot_2018_verkko.pdf

Flores, N. E. (2017). Conceptual framework for nonmarket valuation. Champ et al. (eds.) In *A Primer on Nonmarket Valuation* (pp. 27-54). Retrieved from from https://ebookcentral.proquest.com/lib/helsinki-books/reader.action?docID=4803563&ppg=35

Food and Agriculture Organization of the United Nations, 2020. Global Forest Resources Assessment 2020. Retrieved from http://www.fao.org/3/I8699EN/i8699en.pdf

Grebner, D. L., Bettinger, P., & Siry, J. P. (2012). *Introduction to forestry and natural resources*. Academic Press.

Halstead, J. M., Luloff, A. E., & Stevens, T. H. (1992). Protest bidders in contingent valuation. Northeastern Journal of Agricultural and Resource Economics, 21(2), 160-169.

Hanley, N., Banerjee, S., Lennox, G. D., & Armsworth, P. R. (2012). How should we incentivize private landowners to 'produce'more biodiversity?. Oxford Review of Economic Policy, 28(1), 93-113.

Hanley, N., & White, B. (2014). Incentivizing the provision of ecosystem services. International Review of Environmental and Resource Economics, 7(3–4), 299-331

Hanski, I., & Hammond, P. (1995). Biodiversity in boreal forests. *Trends in Ecology & Evolution*, *10*(1), 5-6.

Holmes, T. P., Adamowicz, W. L., & Carlsson, F. (2017). Choice experiments. Champ et al. (eds.) In *A primer on nonmarket valuation* (pp. 133-186). Retrieved from https://ebookcentral.proquest.com/lib/helsinki-ebooks/reader.action?docID=4803563

Horne, P. (2006). Forest owners' acceptance of incentive based policy instruments in forest biodiversity conservation – a choice experiment based approach. Silva Fennica 40(1): 169–178.

Håbesland, D. E., Kilgore, M. A., Becker, D. R., Snyder, S. A., Solberg, B., Sjølie, H. K., & Lindstad, B. H. (2016). Norwegian family forest owners' willingness to participate in carbon offset programs. *Forest Policy and Economics*, *70*, 30-38.

Hänninen, H. & Karppinen, H. 2010. Yksityismetsänomistajat puntarissa. Julkaisussa: Sevola, Y. (toim.). Metsä, talous, yhteiskunta. Katsauksia metsäekonomiseen tutkimukseen. Metlan työraportteja 145: 55–67.

Hänninen, H., Karppinen, H., & Leppänen, J. (2011). Suomalainen metsänomistaja 2010. Metlan työraportteja 208. Retrieved from http://www.metla.fi/julkaisut/workingpapers/2011/mwp208.htm

Intergovernmental Panel on Climate Change. (2018). Special report on the impacts of global warming of 1.5 °C. Retrieved from https://www.ipcc.ch/sr15/

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., ... & Tourangeau, R. (2017). Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists*, *4*(2), 319-405.

Juutinen, A. 2015. Metsien monet hyödyt ja taloudellinen arvottaminen. Metsätieteen aikakauskirja 2/2015. Retrieved from https://www.metsatieteenaikakauskirja.fi/pdf/article6534.pdf

Kang, M. J., Siry, J. P., Colson, G., & Ferreira, S. (2019). Do forest property characteristics reveal landowners' willingness to accept payments for ecosystem services contracts in southeast Georgia, US?. *Ecological economics*, *161*, 144-152.

Karppinen, H., Hänninen, H., & Horne, P. (2020). *Suomalainen metsänomistaja 2020*. Luonnonvarakeskus. Retrieved from http://urn.fi/URN:ISBN:978-952-326-961-3

Kline, J. D., Mazzotta, M. J., Spies, T. A., & Harmon, M. E. (2013). Applying the ecosystem services concept to public land management. *Agricultural and Resource Economics Review*, *42*(1), 139-158.

Krankina, O. N., & Harmon, M. E. (2006). Forest management strategies for carbon storage. *Forests, carbon, and climate change: a synthesis of science findings. Oregon Forest Resources Institute, Portland, Oregon, USA*, 79-92.

Kuuluvainen, J., Karppinen, H., Hänninen, H. & Uusivuori, J. 2014. Effects of gender and length of land tenure on timber supply in Finland. Journal of Forest Economics 20(4): 363-379

Lancaster, K. J. (1966). A new approach to consumer theory. Journal of political economy, 74(2), 132-157.

Langpap, C. (2004). Conservation incentives programs for endangered species: an analysis of landowner participation. *Land Economics*, *80*(3), 375-388.

Langpap, C., & Kim, T. (2010). Literature review: an economic analysis of incentives for carbon sequestration on nonindustrial private forests (NIPFs). *Alig, RJ, tech. coord. Economic modeling of effects of climate change on the forest sector and mitigation options: a compendium of briefing papers. Gen. Tech. Rep. PNWGTR-833. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station*, 109-142.

Layton, D. F., & Siikamäki, J. (2009). Payments for ecosystem services programs: predicting landowner enrollment and opportunity cost using a beta-binomial model. *Environmental and Resource Economics*, *44*(3), 415.

Louviere, J. J., & Hensher, D. A. (1982). On the design and analysis of simulated choice or allocation experiments in travel choice modelling. *Transportation research record*, *890*(1982), 11-17.

Louviere, J. J., & Woodworth, G. (1983). Design and analysis of simulated consumer choice or allocation experiments: an approach based on aggregate data. *Journal of marketing research*, *20*(4), 350-367.

Lynch, L., & Lovell, S. J. (2003). Combining spatial and survey data to explain participation in agricultural land reservation programs. *Land Economics*, *79*(2), 259-276.

McFadden, D. (1973). Conditional logit analysis of qualitative choice behavior. In: Zarembka P (ed.) Frontiers of Econometrics, Academic Press, New York, 105-142.

Meyerhoff, J., Bartczak, A., & Liebe, U. (2012). Protester or non-protester: a binary state? On the use (and non-use) of latent class models to analyse protesting in economic valuation. Australian Journal of Agricultural and Resource Economics, 56(3), 438-454.

Meyerhoff, J., & Liebe, U. (2010). Determinants of protest responses in environmental valuation: A meta-study. *Ecological Economics*, *70*(2), 366-374.

Meyerhoff, J., Mørkbak, M. R., & Olsen, S. B. (2014). A meta-study investigating the sources of protest behaviour in stated preference surveys. *Environmental and Resource Economics*, *58*(1), 35-57.

METSO (2019). Forest Biodiversity Programme for Southern Finland (METSO). Retrieved from from https://metsonpolku.fi/en-US/METSO_Programme

Millennium Ecosystem Assessment 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC. Retrieved from https://www.millenniumassessment.org/documents/document.356.aspx.pdf

Ministry of Agriculture and Forestry of Finland (2019a). Forest Biodiversity Programme for Southern Finland (METSO). Retrieved from https://mmm.fi/en/forests/biodiversity-and-protection/metso-programme

Ministry of Agriculture and Forestry of Finland (2019b). Forest resources in Finland. Retrieved from https://mmm.fi/en/forests/forestry/forest-resources

Ministry of Agriculture and Forestry of Finland (2019c). The National Forest Strategy 2025 – an updated version Government Resolution of 21 February 2019. Retrieved from http://julkaisut.valtioneuvosto.fi/handle/10024/161386

Ministry of Economic Affairs and Employment of Finland (2017). Government report on the National Energy and Climate Strategy for 2030. Retrieved from https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/79189/TEMjul_4_2017_verkkojulkaisu.pdf?sequence=1&isAllowed=y

Ministry of the Environment of Finland (2018). Climate change mitigation. Retrieved from https://www.ym.fi/en-US/The_environment/Climate_and_air/Mitigation_of_climate_change

Ministry of the Environment of Finland (2019). Kymmenen vuotta METSOa – Väliarviointi Etelä-Suomen metsien monimuotoisuuden toimintaohjelman ensimmäisestä vuosikymmenestä Retrieved from https://julkaisut.valtioneuvosto.fi/handle/10024/161403

Ministry of the Environment of Finland (2020). Helmi-elinympäristöohjelma vahvistaa luonnon monimuotoisuutta**.** Retrieved from https://ym.fi/helmi

Mitani, Y., & Lindhjem, H. (2015). Forest owners' participation in voluntary biodiversity conservation: what does it take to forgo forestry for eternity? *Land Economics*, *91*(2), 235-251.

Natural Resources Institute Finland (2019). Hakkuukertymä 1991-2018. Retrieved from http://statdb.luke.fi/PXWeb/pxweb/fi/LUKE/LUKE__04%20Metsa__02%20Rakenne%20ja%20tuotanto__10%20Hakkuukertyma%20ja%20puuston%20poistuma/01_Hakkuukertyma.px/table/tableViewLayout2/?rxid=dfd699f7-a72f-47d7-b6aa-ca6051524948

Nordén, A., Coria, J., Jönsson, A. M., Lagergren, F., & Lehsten, V. (2017). Divergence in stakeholders' preferences: Evidence from a choice experiment on forest landscapes preferences in Sweden. *Ecological economics*, *132*, 179-195.

OECD Publishing. (2010). *Paying for Biodiversity: Enhancing the Cost-Effectiveness of Payments for Ecosystem Services*. OECD Publishing.

Official Statistics of Finland (2019a). Forest Protection. Retrieved from https://www.stat.fi/til/metsu/index.html

Official Statistics of Finland (2019b). Ownership of Forest Land. Retrieved from http://www.stat.fi/til/metsom/index_en.html

Publications of the Finnish Government (2019). Programme of Prime Minister Antti Rinne's Government 6 June 2019. Retrieved from http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161664/Inclusive%20and%20competent%20Finland_2019_WEB.pdf?sequence=9&isAllowed=y

Rabotyagov, S. S., & Lin, S. (2013). Small forest landowner preferences for working forest conservation contract attributes: A case of Washington State, USA. *Journal of forest economics*, *19*(3), 307-330.

Retief, F., Bond, A., Pope, J., Morrison-Saunders, A., & King, N. (2016). Global megatrends and their implications for environmental assessment practice. Environmental Impact Assessment Review, 61, 52-60.

Secretariat of the Convention on Biological Diversity (2020) Global Biodiversity Outlook 5. Montreal. Retreaved from https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf

Segerson, K. (2017). Valuing environmental goods and services: an economic perspective. Champ et al. (eds.), *A Primer on Nonmarket Valuation* (pp. 1-25). Retrieved from https://ebookcentral.proquest.com/lib/helsinki-ebooks/detail.action?docID=4803563#

Train, K. E. (2009). *Discrete choice methods with simulation*. Cambridge university press.

United Nations (1992). Convention on biological diversity. Retrieved from https://www.cbd.int/doc/legal/cbd-en.pdf

United Nations (2010a). Strategic Plan for Biodiversity 2011-2020, including Aichi Biodiversity Targets. Retrieved from https://www.cbd.int/sp/

United Nations (2010b). Aichi Biodiversity Targets. Retrieved from https://www.cbd.int/sp/targets/

United Nations (2015). Paris Agreement. Retrieved from https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Villanueva, A. J., Glenk, K., & Rodríguez-Entrena, M. (2017). Protest Responses and Willingness to Accept: Ecosystem Services Providers' Preferences towards Incentive-Based Schemes. Journal of agricultural economics, 68(3), 801-821.

Wunder, S., Engel, S., Pagiola, S., 2008. Taking stock: a comparative analysis of payment for environmental services in developed and developing countries. Ecol. Econ. 65, 834–852.

Wunder, S., 2005. Payments for environmental services: some nuts and bolts. Occasional Paper No. 42. Bogor, CIFOR

Zhang, D. (2016). Payments for forest-based environmental services: a close look. *Forest Policy and Economics*, *72*, 78-84.

Appendix 1. Survey questionnaire form in English

Forest survey 2020 University of Helsinki

Dear forest owner!

This survey examines forest owners' visions on forestry, forest biodiversity and the role of forests in sequestration and storage of atmospheric carbon. Carbon sequestration and forest biodiversity are important environmental factors, for example, in the face of climate change.

By responding to the survey, you contribute that we get the most comprehensive view of perceptions of the Finnish forest owners. We use the results of the survey when designing new voluntary financial incentives for forest owners to promote carbon sequestration and biodiversity.

Your answers will be treated in the strictest confidence and no answers or final results can be linked to a person.

Thank you for your participation in advance!

Anna-Kaisa Kosenius, Dr.
University researcher
University of Helsinki

Tiina Paajanen, BSc.
Research assistant
University of Helsinki

Contact: anna-kaisa.kosenius@helsinki.fi, +358 50 4488 593

HELSINGIN YLIOPISTO

IBC-CARBON

Part 1: Your forest

1. What is the total area of your entire forest property?
[You can specify to one decimal place]
I cannot say

2. How many forest holdings do you own?
1
2
3
4 or more
I cannot say

As you own many forest holdings, we ask you to answer the rest of the questions based on your largest forest holding.
[Only if Q2 >1]

3. What is the size of the forest holding in hectares?
[You can specify to one decimal place]
I cannot say

4. In which municipality the forest holding is located?
[List of municipalities]

5. Which of the following best describes the ownership of the forest holding?
I own it myself or with a partner
Concern
Heirs

6. How did you get / purchase the forest holding?
Heritage or gift
Purchase from my parents or relatives
Purchase from the markets
Other, please specify
I cannot say

7. From which year have you owned the forest holding?
[Year]
I cannot say

8. How important is the implementation of the following matters to you on your forest holding?
[Order randomized]
[5=Very important, 4,…,1=Not important at all, I cannot say]

Financing source for large purchases and/or regular consumption
Financial security (e.g. for exceptional situations or retirement)
Investment, appreciation of forest plots
Income from work in own forest
Berry and/or mushroom picking at the forest holding
Hunting at the forest holding
Relaxation (outdoor activities, meditation and quieting down)
Forestry work and/or wood for household use
Time with family or relatives
Heritage to close relatives
Connection for the home region
Other business activities in the forest holding (e.g. nature tourism)
Climate change mitigation
Biodiversity conservation
Water system conservation from organic matter and nutrient run-offs
Air quality conservation by filtering impurities

Part 2: Forest and nature management – timber production, biodiversity and carbon storage

9. Does the forest holding have a forest management plan?
Yes
No
I cannot say

10.Which of the following have been implemented (yourself or as a service) on your forest holding during 2017-2019?
[Choose all that apply]
Forest seeding or afforestation, natural renewal, maintenance of sapling stand, renovation of young forest and/or cutting of standing trees
Fertilization
Drainage (renovation or renewal)
Conservation of commercial forests (e.g. artificial snags, retention trees and buffer zones of water systems)
Timber and pulpwood sales
Fuelwood sales
None of these
I cannot say

11. How often do you sell wood from your forest holding?
Every year
On average every other year
On average every three or four years

Approximately every five years
Rarely than every five years
I have not sold in 10 years
I have never sold
I cannot say

12. When did you last sell wood?
[Not if Q10 ”I have never sold” or “I cannot say”]
[Year]
I cannot say

13. Estimate your household's annual forest income share of total income during 2017-2019 (annual average)
Less than 5%
6-10%
11-25%
26-50%
More than 50%
I cannot say
I do not want to answer

14. Please assess the following statements concerning decision-making related to your forest
[Totally agree, partly agree, neither agree nor disagree, partly disagree, totally disagree, I cannot say]

I know myself how to manage / not to manage my own forest
I have received enough information related to the forest
I would like to participate in events that convey forest information
I would like the forest service provider to take care of my forest related matters for me
I am well able to manage forestry matters from my place of residence
The things I want to be done in my forest are done there
The goals set by others affect the management and use of the forest more than my own goals
I get to influence decision making concerning my forest
My forest is managed according to my views, values and goals
My parents and relatives guide me in making forest-related decisions
I use the information in the metsään.fi service to make decisions about my forest
I want to get more information about the natural values of my forest

Forest biodiversity

Biodiversity of forest ecosystems contribute **the resilience of environment to the changing climate conditions.** The objective of Finland (in its biodiversity strategy) is to prevent/halt the degradation of the habitats of plant, fungal and animal species.

The biodiversity of forest ecosystems is promoted:

- In the commercial forests through, among other things, the protection based on the Nature Conservation Act, nature management activities and lightened forest management. The Nature Conservation Act protects the habitats that are especially valuable for biodiversity, such as herb-rich and grassy hardwood-spruce swamps and ravines.
- In the protected forest areas through, among other things, non-management of the forest site. The protected site may be a part of, for example, a voluntary Forest Biodiversity Programme for Southern Finland (the METSO Programme) where the forest owner is paid for the protection of the site.

Forest carbon sequestration and storage

Trees and forest land sequester carbon from the atmosphere and store it, which **slows down climate change.** For example, old forests are large carbon storages. New research suggests that old forests may remain as a carbon sinks for longer than previously estimated.

Carbon storage = The amount of stored carbon

- Old forest is a larger carbon storage than a young forest
- Carbon is stored in the stand, soil, surface vegetation and swamp peat layers

Carbon sink = The carbon storage increases, meaning that more carbon is sequestered than released

- Young forest grows fast and sequesters more atmospheric carbon than old and slower growing forest
- Old forest sequesters carbon slower to slower-growing trees. When a dead tree decays, carbon is released slowly.

Part 3: Promoting biodiversity and carbon storage on a voluntary basis by the forest owner

Securing forest biodiversity and promoting carbon sequestration and storage can be implemented in several ways. In this survey, we focus on the forest owner's voluntary-based program and ask to evaluate it.

The forest owner can offer a specific forest area (forest site) to the program and receive compensation. A forest site suitable for the program may be, for example, around a good biodiversity feature. The offered forest site may be suitable for the program as it is, or it may require some nature management work to be done or commissioned. The costs of nature management work will be compensated. Nature management promote the formation of natural values in the area (for example, the abandonment of decaying trees or deciduous trees). It is beneficial for biodiversity if the offered forest site is as wide as possible and / or located close to other valuable areas for biodiversity.

The program is committed to by an agreement and the forest area remains under the control of the forest owner. The area is permanently out of forestry, but other business is possible. The lump sum compensation paid to the forest owner is determined by the quality of the area's biodiversity and the amount of carbon sequestered.

The following questions will help you to consider what you might want to offer to the voluntary protection program - for appropriate compensation. The forest site you offer can be a part of your forest property or your entire forest.

Answering the questions do not oblige you to anything but helps us to design voluntary-based incentives.

16. What is the size of the offered forest site in hectares?
[You can specify to one decimal place and clarify verbally]

17. Which of the following features does the offered site have?
[Choose all that apply]
Drained pine-dominated swamp
Display areas of forest fowls
Nests of birds of prey
Rivers, streams or ponds and their beach forests
Not-drained wilderness (spruce-dominated swamp)
Old trees or groups of old trees outside the forestry sector
Stricken area caused by fire, wind and/or snow
Wooded rocks, steep bluffs and/or boulder fields
Ridge forest
Groves
None of these
Other, please specify
I cannot say

18. Estimate the amount of stand in the offered site (m3/whole area)

0-100 m3
101-200 m3
201-300 m3
301-400 m3
More than 400 m3
I cannot say

19. Estimate the age of the stand in the offered site (if there is a multi-age forest, estimate the age of the oldest part of the forest)
[You can also verbally specify the age of the stand in the answer field]

20. What is the main tree species in the offered site?
Pine
Spruce
Birch
Mixed species
I cannot say

21. Is the offered site on mineral or peat soil?
Mineral soil
Peat soil
Both
I cannot say

22. Estimate the number of decaying trees over 20 cm in diameter in the offered site (pcs/hectare)
0 pcs
1-5 pcs
6-10 pcs
11-20 pcs
More than 20 pcs
I cannot say

23. Estimate the share of deciduous trees in the stand in the offered site
None
1-10%
11-20%
21-30%
More than 30%
I cannot say

Next, we ask you to evaluate a new voluntary program, where the forest owner is paid for promoting carbon sequestration and storage and securing biodiversity.

- The program is permanent, and the agreement binds also the potential future owners
- The authorities and the non-profit organization are responsible for the implementation of the program
- The lump sum compensation is determined by the quality of the site's biodiversity and the amount of carbon sequestered
- Carbon sequestration and biodiversity are assessed using the latest technologies, such as remote sensing
- Forestry is not allowed, and firewood cannot be harvested on site

The program can be implemented in several ways, with the following attributes varying:

Eligibility of the forest area
- The site may be eligible for the program as it is or
- The site may require some nature management work to be done or commissioned (e.g. the abandonment of decaying trees or deciduous trees), which will be compensated

Conducting non-timber business on the area, i.e. hunting and nature tourism (however, without permanent structures built)
- It is allowed or
- It is not allowed, depending on what is recorded in the agreement

Payment for carbon (€/ha)
- Lump sum payment per hectare to the forest owner for carbon sequestration and storage of the site

Payment for biodiversity (€/ha)
- Lump sum payment per hectare to the forest owner based on the quality of the site's biodiversity (e.g. proportion of deciduous and decaying trees and age of stands)

Next, evaluate six voluntary programs in which the eligibility of the area, the possibility to conduct non-timber business on the area, the payment for biodiversity and the payment for carbon sequestration vary.
Please evaluate the programs separately, not by comparing them.

24. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable	Conducting non-timber business allowed	Payment for carbon 120 €/ha	Payment for biodiversity 530 €/ha
Increases attractiveness the most				
Increases attractiveness the least				

25. Would you participate in this program if it was available to your forest holding?
Yes
No

26. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable	Conducting non-timber business not allowed	Payment for carbon 680 €/ha	Payment for biodiversity 9,700 €/ha
Adds the attractiveness the most				
Adds the attractiveness the least				

27. Would you participate in this program if it was available to your forest holding?
Yes
No

28. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable after nature management	Conducting non-timber business not allowed	Payment for carbon 200 €/ha	Payment for biodiversity 6,800 €/ha
Adds the attractiveness the most				
Adds the attractiveness the least				

29. Would you participate in this program if it was available to your forest holding?

Yes
No

30. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable	Conducting non-timber business allowed	Payment for carbon 0 €/ha	Payment for biodiversity 720 €/ha
Adds the attractiveness the most				
Adds the attractiveness the least				

31. Would you participate in this program if it was available to your forest holding?
Yes
No

32. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable after nature management	Conducting non-timber business allowed	Payment for carbon 360 €/ha	Payment for biodiversity 5,200 €/ha
Adds the attractiveness the most				
Adds the attractiveness the least				

33. Would you participate in this program if it was available to your forest holding?
Yes
No

34. How do the following ways of implementation affect the attractiveness of the program in case of your forest holding?

Choose the one that adds attractiveness the most the one that adds attractiveness the least.

	Forest area suitable	Conducting non-timber business allowed	Payment for carbon 80 €/ha	Payment for biodiversity 1,100 €/ha
Adds the attractiveness the most				
Adds the attractiveness the least				

35. Would you participate in this program if it was available to your forest holding?
Yes
No

36. Why would you not participate in the program?
[Only if 24, 26, 28, 30, 32 or 34 is ”no”]
[Choose all that apply]
The offered compensation is not sufficient in relation to the economic value of my forest
The offered compensation is not sufficient in relation to the ecological value of my forest
I do not want to bind my forest to a permanent conservation program
There are no suitable biodiversity features in my forest
I do not need official programs to protect my forest
I am not interested in forest protection
Other, please specify

Part 4: Your perceptions of forest management and forest conservation

37. Evaluate the following statements in terms of your own forest management and forest property
[Totally agree, partly agree, neither agree nor disagree, partly disagree, totally disagree, I cannot say]

I need more information about the features of my forest to consider joining the conservation program

Instead of a lump sum, I would prefer an annual payment for the program
The transition to continuous cover forestry will make a significant contribution to maintain forest carbon storage
Carbon offsetting is the climate policy of the future
The weak state of Finland's forest biodiversity is exaggerated
Increasing deforestation cannot increase carbon sequestration

The impact of forestry in waters is exaggerated

Forest biodiversity can be increased through forest management activities

I do not want to think of natural resources as a market commodity

It is important to keep the felling potential of the forest holding stable

Old forests must be preserved for future generations

I am planning to sell my forest property

Increasing deforestation impairs the conservation of biodiversity

I am proud to know that my forest provides benefits to society in addition to my own benefits

I am planning to alienate my forest to my heirs

The economic exploitation of commercial forests is the best climate policy

38. Evaluate the following statements in terms of your own forest management and forest property
[Totally agree, partly agree, neither agree nor disagree, partly disagree, totally disagree, I cannot say]

I understand the importance of forestry in climate change mitigation
I am concerned that the climate change could significantly increase the risk of forest damage
My family tends to leave part of the forest out of timber production
I am not interested in protecting biodiversity in my forest
Simultaneous protection of forest biodiversity and carbon storage is possible on my forest holding

I would rather sell my forest property to a nature conservation organization than to any other private buyer

I am interested in participating in the carbon trade

The conservation values of my forest depend on how the forest is managed on neighbor forest holdings

I have a duty to protect nature

My family and / or loved ones think that forest protection is a good deed

My forest offers me aesthetic experiences

I do not support the idea of restrictions on forest management

I am interested in active nature management that promotes biodiversity

39. How important do you consider the following factors for the sustainability of Finnish forestry?
[Very important=5, 4,…, Not important at all=1, I cannot say]
Cuttings are decreased to protect biodiversity
Forest reserves are increased to obtain larger carbon storages

A forest owner receives a reasonable price for timber
By-products of forest industry are used to produce biofuels
Forestry employs many people
Timber cuttings are decreased to mitigate climate change
Fossil materials and fuels are replaced by raw wood materials

40. What else would you like to say about the topic of the survey?
[You can write your comments here]
[Open answer, not mandatary to reply]

41. Next, one question that is not related to your forest.

Think of a situation where you have the opportunity to participate in one draw where the winning amount is solved by rolling the dice. There are two alternative payouts, each with a 50 percent probability. If you had to choose one draw you would prefer to participate in, which of the following draws would you choose?

Draw	If the number of dots is 1, 2 or 3	If the number of dots is 4, 5 or 6
1	40 €	40 €
2	32 €	51 €
3	24 €	64 €
4	16 €	78 €
5	12 €	86 €
6	8 €	91,5 €
7	6 €	92,9 €
8	4 €	93,4 €
9	1 €	93,5 €

Part 5: Background questions

42. Which of the following options describe your situation?
[Choose all that apply]
I permanently live in the forest holding
My leisure home is in the forest holding
The forest holding is not related to residency
I cannot say

43. In which of the following organizations are you in/a member?
[Choose all that apply]

Forest owner organization
The Central Union of Agricultural Producers and Forest Owners (MTK)
Other forest owner organization e.g. local
A contact customer of a forest company
Conservation organization
Hunting club (renter)
Hunting club (a member)
None of these
I cannot say

44. How old are you?
[Open]

45. Your gender?
Female
Male
Other
I do not want to answer

46. How many people are in your household, including yourself?
[Open]

47. Do you live…
in Finland
abroad

48. What is your municipality?
[Only asked if 47=1]
[Drop-down list]

49. Which of the following corresponds to your current living environment?
City center
Urban environment
Rural / sparsely populated area

50. Which of the following corresponds to the main living environment of your childhood?
City center
Urban environment
Rural / sparsely populated area

51. What is your education?
Primary school, elementary school or basic school
Vocational undergraduate degree, vocational school

High School graduate
College level vocational undergraduate degree
University of applied sciences or bachelor's degree of university or college
Master's degree or higher of university or college
Other

52. Which of the following best describes your occupational group or situation?
A leading position employed by another
Senior officer
Junior officer
Worker
Entrepreneur or self-employed
A farmer
Unemployed
Schoolchild or student
Pensioner
Stay-at-home parent
Other
I cannot say

53. What is the total annual net income of your household?
Less than 20,000 euros
20,001 – 35,000 euros
35,001 - 50.000 euros
50,001 - 85.000 euros
85,001 - 100.000 euros
More than 100,000 euros
No reply
I cannot say

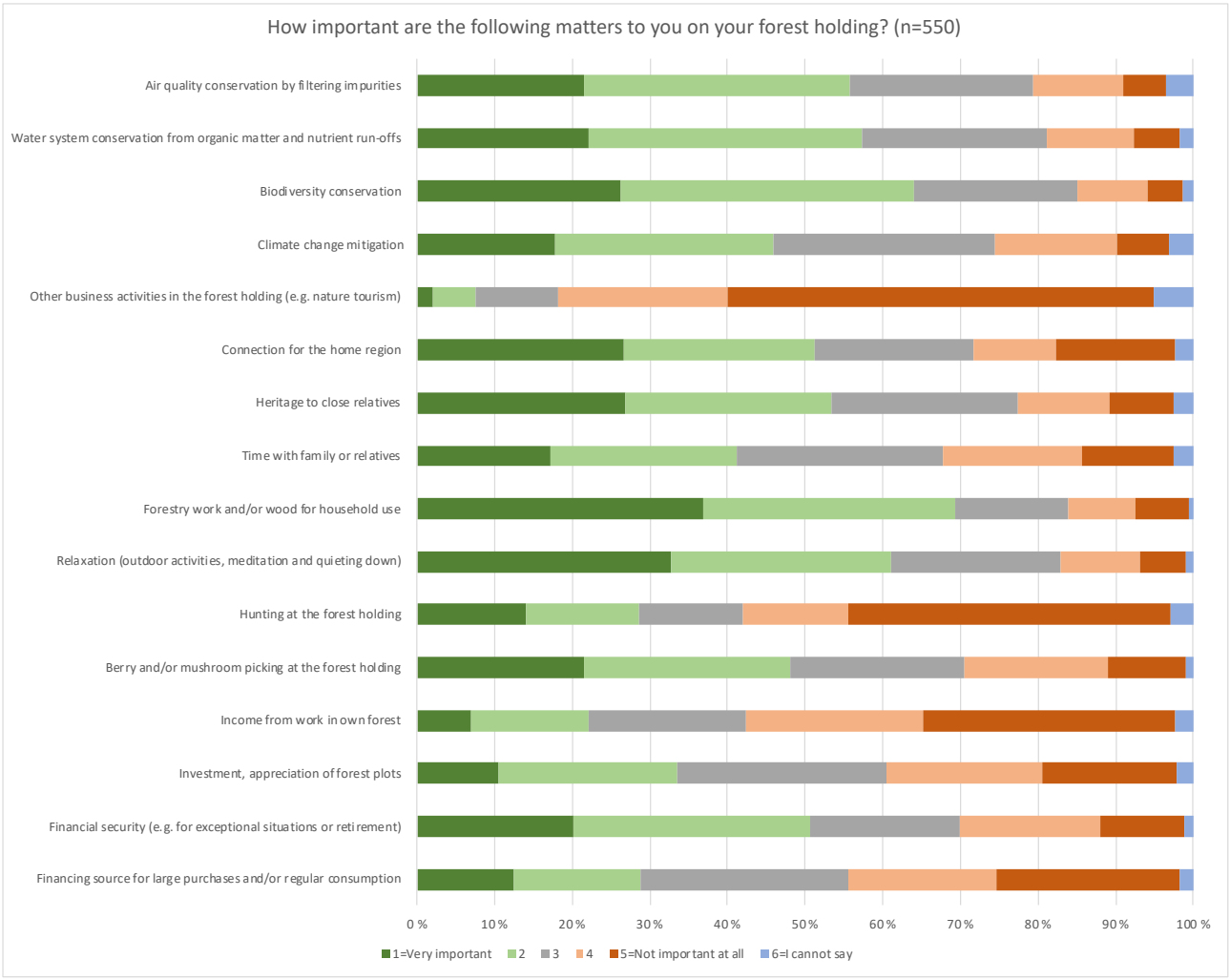
Appendix 2. Table of the descriptive statistics of the socio-economic characteristics of the sample

	Sample average
Age (N=338)	59
Household size (N=337)	2,3
Gender (N=338)	
Female	29%
Male	70%
Other	1%
Education (N=377)	
Primary school, elementary school or basic school	11%
Vocational undergraduate degree, vocational school	21%
High School graduate	5%
College level vocational undergraduate degree	18%
University of applied sciences or bachelor's degree of university or college	19%
Master's degree or higher of university or college	26%
Occupational group or situation (N=377)	
A leading position employed by another	5%
Senior officer	16%
Junior officer	7%
Worker	15%
Entrepreneur or self-employed	7%
A farmer	7%
Unemployed	2%
Schoolchild or student	1%
Pensioner	39%
Stay-at-home parent	1%
Other	1%
Household's total annual net income (N=377)	
Less than 20,000 euros	6%
20,001 – 35,000 euros	15%
35,001 - 50.000 euros	18%
50,001 - 85.000 euros	23%
85,001 - 100.000 euros	11%
More than 100.000 euros	15%
No answer	9%
Cannot say	3%
Current living environment (N=377)	
City center	14%
Urban environment	35%
Rural / sparsely populated area	51%
Childhood living environment (N=377)	
City center	5%
Urban environment	18%
Rural / sparsely populated area	77%
Housing in relation to the forest holding (N=315)	
Permanent residency on the forest holding	28%
Leisure home on the forest holding	31%
The forest holding is not related to residence	41%
Cannot say	1%
Membership in organizations (N=338)	
Forest owner organization	67%
The Central Union of Agricultural Producers and Forest Owners (MTK)	19%
Other forest owner organization e.g. local	5%
A contact customer of a forest company	19%
Conservation organization	8%
Hunting club (renter)	60%
Hunting club (a member)	28%
None of these	9%
Cannot say	2%

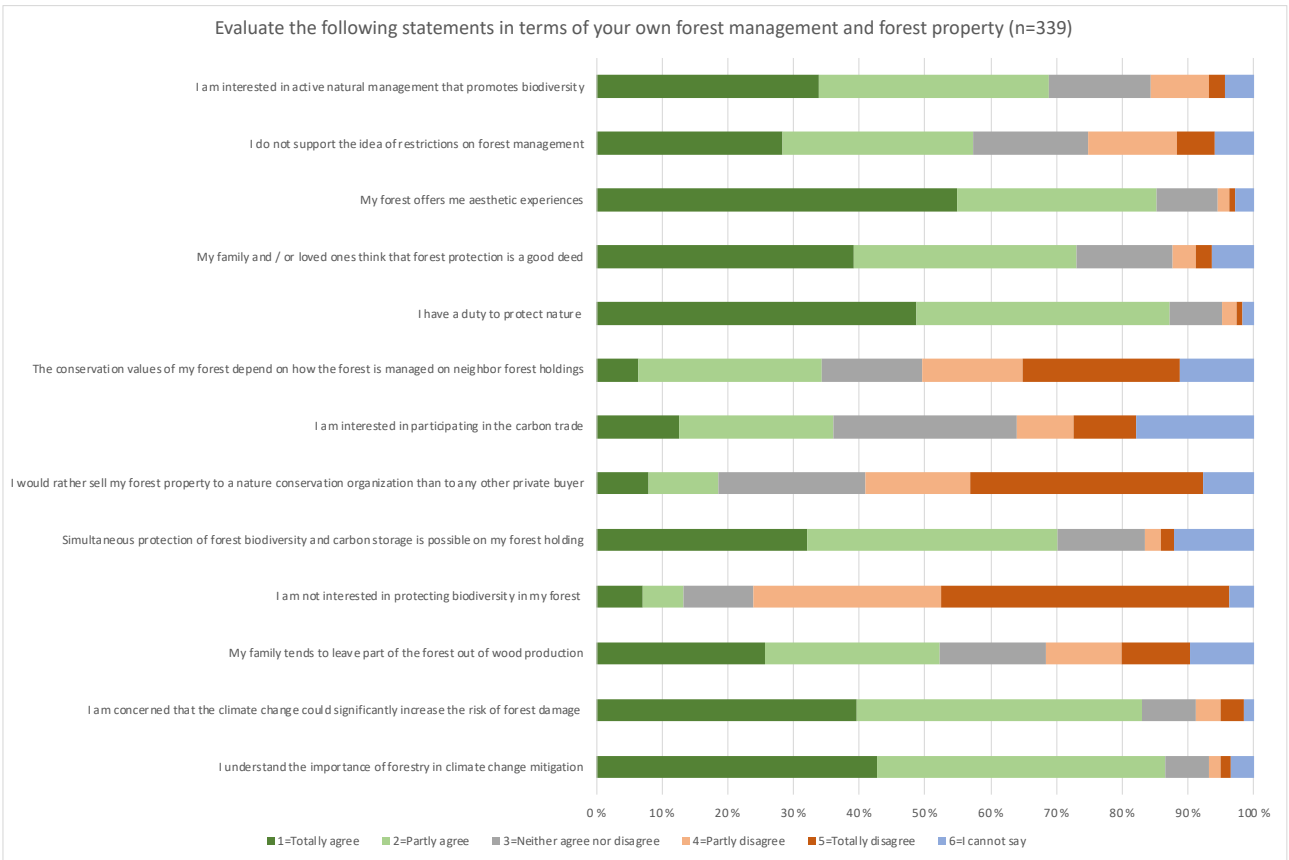
Appendix 3. Table of the descriptive statistics of the forest property characteristics of the sample

	Sample average
The total area of entire forest property (N=428)	86 ha
Size of largest forest holding (N=420)	52 ha
Forest holding ownership since year (N=523)	2001
Number of forest holdings (N=585)	
1	49%
2	23%
3	13%
4 or more	13%
Cannot say	2%
Ownership of the forest holding (N=573)	
By oneself or with a spouse	74%
Consortium	19%
Estate	6%
Way to get / purchase the forest holding (N=571)	
Heritage or gift	41%
Purchase from parents or relatives	36%
Purchase from the markets	21%
Cannot say	1%
Heritage and purchase	1%
Through marriage	1%
Purchase from someone known	1%
Forest management plan (N=549)	
Yes	69%
No	26%
Cannot say	6%
Household's annual forest income of total income during 2017-2019 (N=544)	
Less than 5%	52%
6-10%	17%
11-25%	9%
26-50%	7%
More than 50%	2%
Cannot say	11%
Do not want to answer	2%
Implemented matters on forest holding during 2017-2019? (N=548)	
Forest seeding or afforestation, natural renewal, maintenance of sapling stand, renovation of young forest and/or cutting of standing trees	74%
Fertilization	9%
Drainage (renovation or renewal)	16%
Conservation of commercial forests (e.g. artificial snags, retention trees and buffer zones of water systems)	24%
Timber and pulpwood sales	61%
Fuelwood sales	29%
None of these	15%
Cannot say	1%
Timber sales (N=548)	
Every year	7%
On average every other year	5%
On average every three or four years	12%
Approximately every five years	16%
Rarely than every five years	34%
Have not sold in 10 years	8%
Have never sold	15%
Cannot say	2%

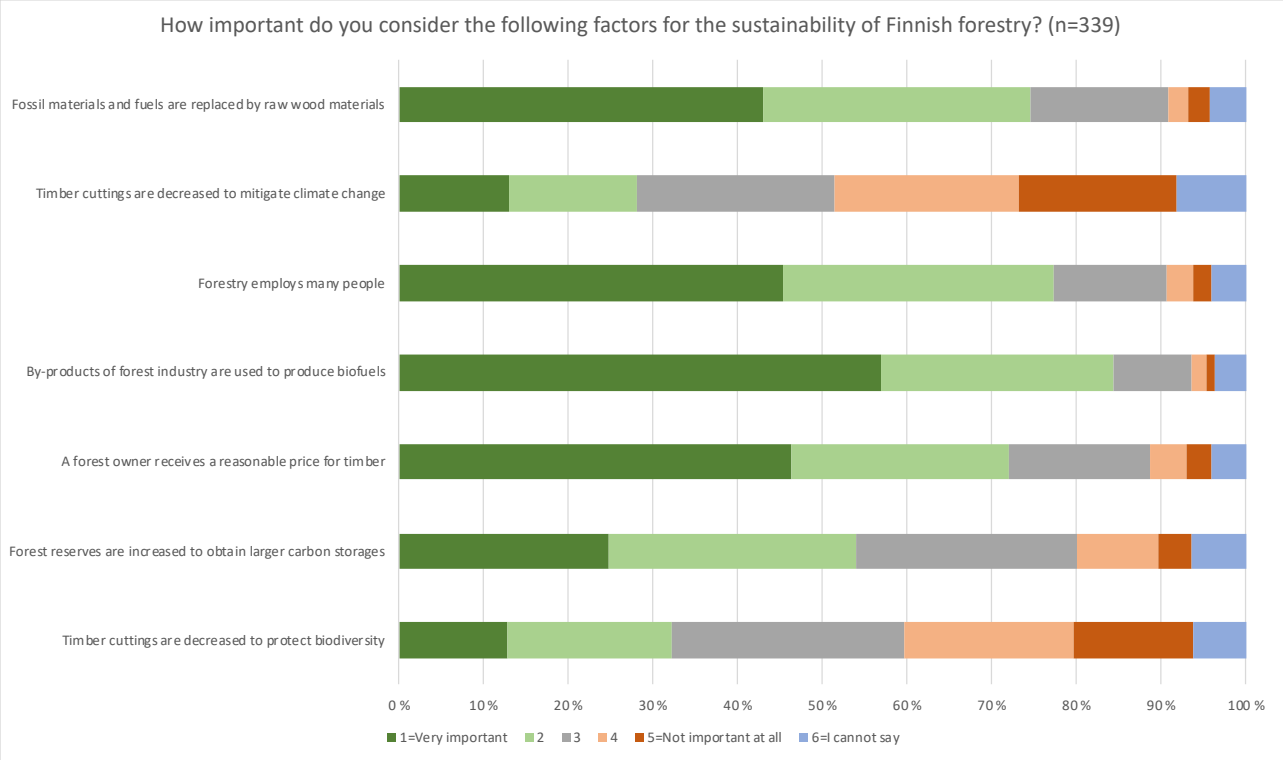
Appendix 4. Figure of the importance of the matters on respondents' forest holding



Appendix 5. Figures of the statements in terms of respondents' own forest management and forest property



Appendix 6. Figure of the importance of factors for the sustainability of Finnish forestry



Appendix 7. Statistical tests of serial non-participants

						- = no statistically significance difference
		n=379				
		Serial non-participants (n=170)			**Share**	
Questions		0	1	P-value	Others	Serial
What is the total area of your entire forest property?				-		
How many forest holding do you own				-		
	1					
	2					
	3					
	4 or more					
	5					
Size of largest forest site				-		
Which of the following best describes the ownership of the forest holding?				-		
	I own it myself or with a partner					
	Concern					
	Heirs					
How did you get / purchase the forest holding?				-		
	Heritage or gift					
	Purchase from my parents or relatives					
	Purchase from the markets					
	I cannot say					
	Heritage and purchase					
	Through marriage					
	National Board of Agriculture					
	Purchase from someone I know					
Heritage				-		
Other						
Purchase				-		
Other						
From which year have you owned the forest holding?				-		
How important is the implementation of the following matters to you on your forest holding?						
Financing source for large purchases and/or regular consumption				-		
	Important					
	Other					
Financial security (e.g. for exceptional situations or retirement)				-		
	Important					
	Other					
Investment, appreciation of forest plots				-		
	Important					
	Other					
Income from work in own forest				-		
	Important					
	Other					
Berry and/or mushroom picking at the forest holding				-		
	Important					
	Other					
Hunting at the forest holding				-		
	Important					
	Other					
Relaxation (outdoor activities, meditation and quieting down)				-		
	Important					
	Other					
Forestry work and/or wood for household use				-		
	Important					
	Other					
Time with family or relatives				-		
	Important					
	Other					
Heritage to close relatives				-		
	Important					
	Other					

Connection for the home region			-			
	Important					
	Other					
Other business activities in the forest holding (e.g. nature tourism)			-			
	Important					
	Other					
Climate change mitigation				0,002		
	Important	115	67		0,55	0,39
	Other	94	103			
Biodiversity conservation				0,001		
	Important	154	97		0,74	0,57
	Other	55	73			
Water system conservation from organic matter and nutrient run-offs				0,001		
	Important	138	84		0,66	0,49
	Other	71	86			
Air quality conservation by filtering impurities			-			
	Important					
	Other					
Does the forest holding have a forest management plan?			-			
	Yes					
	No					
	I cannot say					
Which of the following have been implemented (yourself or as a service) on your forest holding during 2017-2019?						
Forest seeding or afforestation, natural renewal, maintenance of sapling stand, renovation of young forest and			-			
Fertilization			-			
Drainage (renovation or renewal)			-			
Conservation of commercial forests (e.g. artificial snags, retention trees and buffer zones of water systems)			-			
Timber and pulpwood sales			-			
Fuelwood sales			-			
None of these			-			
I cannot say			-			
How often do you sell wood from your forest holding?			-			
Every year						
On average every other year						
On average every three or four years						
Approximately every five years						
Rarely than every five years						
I have not sold in 10 years						
I have never sold						
I cannot say						
Every 5 years or often			-			
Other						
Rarely than every 5 years			-			
Other						
Estimate your household's annual forest income share of total income during 2017-2019 (annual average)			-			
Less than 5%						
6-10%						
11-25%						
26-50%						
More than 50%						
I cannot say						
I do not want to answer						
Less than 5%			-			
Other						
More than 26%			-			
Other						

How well do you know the voluntary METSO Programme?						
I have a METSO forest site: a 10-year contract of environmental support by the F				0,006		
	0	192	166			
	1	17	3		0,08	0,02
I have a METSO forest site: a 20-year contract, based on the law of nature conser			-			
	0					
	1					
I have permanently protected forest site in the METSO Programme			-			
	0					
	1					
I have a forest site protected by another programme than METSO			-			
	0					
	1					
I know someone who has a METSO forest site			-			
	0					
	1					
I have heard about the METSO Programme			-			
	0					
	1					
I first heard about the METSO Programme in this survey				0,038		
	0	175	127			
	1	34	42		0,16	0,25
Evaluate the following statements in terms of your own forest management and forest property						
I need more information about the features of my forest to consider joining the co				0,000		
	Argee	128	47		0,65	0,32
	Other	70	98			
Instead of a lump sum, I would prefer an annual payment for the program				0,000		
	Argee	128	65		0,65	0,45
	Other	70	80			
The transition to continuous cover forestry will make a significant contribution to			-			
	Argee					
	Other					
Carbon offsetting is the climate policy of the future				0,004		
	Argee	128	71		0,65	0,49
	Other	70	74			
The weak state of Finland's forest biodiversity is exaggerated			-			
	Argee					
	Other					
Increasing deforestation cannot increase carbon sequestration			-			
	Argee					
	Other					
The impact of forestry in waters is exaggerated			-			
	Argee					
	Other					
Forest biodiversity can be increased through forest management activities			-			
	Argee					
	Other					
I do not want to think of natural resources as a market commodity			-			
	Argee					
	Other					
It is important to keep the felling potential of the forest holding stable			-			
	Argee					
	Other					
Old forests must be preserved for future generations				0,000		
	Argee	167	96		0,84	0,66
	Other	31	49			
I am planning to sell my forest property			-			
	Argee					
	Other					
Increasing deforestation impairs the conservation of biodiversity				0,019		
	Argee	99	54		0,50	0,37
	Other	99	91			

I am proud to know that my forest provides benefits to society in addition to my own benefits				0,000		
	Argee	149	81		0,75	0,56
	Other	49	64			
I am planning to alienate my forest to my heirs				-		
	Argee					
	Other					
The economic exploitation of commercial forests is the best climate policy				-		
	Argee					
	Other					
Evaluate the following statements in terms of your own forest management and forest property						
I understand the importance of forestry in climate change mitigation				0,034		
	Argee	176	117		0,90	0,82
	Other	20	26			
I am concerned that the climate change could significantly increase the risk of forest damage				-		
	Argee					
	Other					
My family tends to leave part of the forest out of timber production				0,001		
	Argee	118	59		0,60	0,41
	Other	78	84			
I am not interested in protecting biodiversity in my forest				0,009		
	Argee	18	27		0,09	0,19
	Other	178	116			
Simultaneous protection of forest biodiversity and carbon storage is possible on my forest holding				0,006		
	Argee	149	89		0,76	0,62
	Other	47	54			
I would rather sell my forest property to a nature conservation organization than to any other private buyer				0,001		
	Argee	48	15		0,24	0,10
	Other	148	128			
I am interested in participating in the carbon trade				0,000		
	Argee	99	23		0,51	0,16
	Other	97	120			
The conservation values of my forest depend on how the forest is managed on neighbor forest holdings				ei eroa		
	Argee					
	Other					
I have a duty to protect nature				0,003		
	Argee	180	116		0,92	0,81
	Other	16	27			
My family and / or loved ones think that forest protection is a good deed				-		
	Argee					
	Other					
My forest offers me aesthetic experiences				-		
	Argee					
	Other					
I do not support the idea of restrictions on forest management				0,024		
	Argee	102	92		0,52	0,64
	Other	94	51			
I am interested in active nature management that promotes biodiversity				0,000		
	Argee	157	76		0,80	0,53
	Other	39	67			
How important do you consider the following factors for the sustainability of Finnish forestry?						
[Very important=5, 4,…, Not important at all=1, I cannot say]						
Cuttings are decreased to protect biodiversity				0,005		
	Important	75	34		0,38	0,24
	Other	121	109			
Forest reserves are increased to obtain larger carbon storages				-		
	Important					
	Other					
A forest owner receives a reasonable price for timber				-		
	Important					
	Other					

By-products of forest industry are used to produce biofuels			-
	Important		
	Other		
Forestry employs many people			-
	Important		
	Other		
Timber cuttings are decreased to mitigate climate change			-
	Important		
	Other		
Fossil materials and fuels are replaced by raw wood materials			-
	Important		
	Other		
Which of the following options describe your situation?			-
	I permanently live in the forest holding		
	My leisure home is in the forest holding		
	The forest holding is not related to residency		
	I cannot say		
I permanently live in the forest holding			-
Other			
My leisure home is in the forest holding			-
Other			
The forest holding is not related to residency			-
Other			
In which of the following organizations are you in/a member?			
	Forest owner organization		
	0		
	1		-
	The Central Union of Agricultural Producers and Forest Owners (MTK)		
	0		
	1		-
	Other forest owner organization e.g. local		
	0		
	1		-
	A contact customer of a forest company		
	0		
	1		-
	Conservation organization		
	0		
	1		-
	Hunting club (renter)		
	0		
	1		-
	Hunting club (a member)		
	0		
	1		-
	None of these		
	0		
	1		-
	I cannot say		
	0		
	1		-
How old are you?			-
Agemax40			-
	Max 40		
	More than 40		
Your gender?			
	Female	47	52 -
	Male	149	86
	Other	0	4

Male	149	86	0,002	0,76	0,61
Other than male	47	56			
How many people are in your household, including yourself?		-			
Do you live…			0,041		
in Finland	195	139		1,00	0,98
abroad	0	3		0,00	0,02
Which of the following corresponds to your current living environment?		-			
City center					
Urban environment					
Rural / sparsely populated area					
Urban		-			
Rural					
Which of the following corresponds to the main living environment of your childhood?		-			
City center					
Urban environment					
Rural / sparsely populated area					
Urban		-			
Rural					
What is your education?		-			
Primary school, elementary school or basic school					
Vocational undergraduate degree, vocational school					
High School graduate					
College level vocational undergraduate degree					
University of applied sciences or bachelor's degree of university or college					
Master's degree or higher of university or college					
Other					
Master's degree or higher		-			
Other					
Which of the following best describes your occupational group or situation?		-			
A leading position employed by another					
Senior officer					
Junior officer					
Worker					
Entrepreneur or self-employed					
A farmer					
Unemployed					
Schoolchild or student					
Pensioner					
Stay-at-home parent					
Other					
I cannot say					
Pensioner		-			
Other					
Entrepreneur or self-employed		-			
Other					
What is the total annual net income of your household?		-			
Less than 20,000 euros					
20,001 – 35,000 euros					
35,001 - 50.000 euros					
50,001 - 85.000 euros					
85,001 - 100.000 euros					
More than 100.000 euros					
No answer					
I cannot say					
Less than 20,000 euros		-			
Other					
85,001 or more		-			
Other					

Appendix 8. Statistical tests of protesters

				- = no statistically significance difference			
		n=285					
		Protesters (n=107)			**Share**		
Questions		0	1	P-value	Others	Serial	
What is the total area of your entire forest property?				-			
How many forest holding do you own							
	1						
	2						
	3						
	4 or more						
	5						
Size of largest forest site				-			
Which of the following best describes the ownership of the forest holding?				-			
	I own it myself or with a partner						
	Concern						
	Heirs						
How did you get / purchase the forest holding?				-			
	Heritage or gift						
	Purchase from my parents or relatives						
	Purchase from the markets						
	I cannot say						
	Heritage and purchase						
	Through marriage						
	National Board of Agriculture						
	Purchase from someone I know						
Heritage				-			
Other							
Purchase				-			
Other							
From which year have you owned the forest holding?				-			
How important is the implementation of the following matters to you on your forest holding?							
Financing source for large purchases and/or regular consumption				-			
	Important						
	Other						
Financial security (e.g. for exceptional situations or retirement)				-			
	Important						
	Other						
Investment, appreciation of forest plots				-			
	Important						
	Other						
Income from work in own forest					0,008		
	Important	53	17			0,30	0,16
	Other	125	90				
Berry and/or mushroom picking at the forest holding				-			
	Important						
	Other						
Hunting at the forest holding				-			
	Important						
	Other						
Relaxation (outdoor activities, meditation and quieting down)				-			
	Important						
	Other						
Forestry work and/or wood for household use				-			
	Important						
	Other						
Time with family or relatives				-			
	Important						
	Other						
Heritage to close relatives				-			
	Important						
	Other						

Connection for the home region			-			
	Important					
	Other					
Other business activities in the forest holding (e.g. nature tourism)			-			
	Important					
	Other					
Climate change mitigation				0,045		
	Important	90	41		0,51	0,38
	Other	88	66			
Biodiversity conservation			-			
	Important					
	Other					
Water system conservation from organic matter and nutrient run-offs				0,023		
	Important	111	52		0,62	0,49
	Other	67	55			
Air quality conservation by filtering impurities			-			
	Important					
	Other					
Does the forest holding have a forest management plan?			-			
	Yes					
	No					
	I cannot say					
Which of the following have been implemented (yourself or as a service) on your forest holding during 2017-2019?						
Forest seeding or afforestation, natural renewal, maintenance of sapling stand, renovation of young forest and			-			
Fertilization			-			
Drainage (renovation or renewal)			-			
Conservation of commercial forests (e.g. artificial snags, retention trees and buffer zones of water systems)			-			
Timber and pulpwood sales			-			
Fuelwood sales			-			
None of these			-			
I cannot say			-			
How often do you sell wood from your forest holding?			-			
Every year						
On average every other year						
On average every three or four years						
Approximately every five years						
Rarely than every five years						
I have not sold in 10 years						
I have never sold						
I cannot say						
Every 5 years or often			-			
Other						
Rarely than every 5 years			-			
Other						
Estimate your household's annual forest income share of total income during 2017-2019 (annual average)			-			
Less than 5%						
6-10%						
11-25%						
26-50%						
More than 50%						
I cannot say						
I do not want to answer						
Less than 5%			-			
Other						
More than 26%		30	4	0,001	0,17	0,04
Other		148	103			

How well do you know the voluntary METSO Programme?						
I have a METSO forest site: a 10-year contract of environmental support by the Forest Centre				0,016		
	0	165	106		0,93	0,99
	1	13	1		0,07	0,01
I have a METSO forest site: a 20-year contract, based on the law of nature conservation and the Centre for E				-		
	0					
	1					
I have permanently protected forest site in the METSO Programme				-		
	0					
	1					
I have a forest site protected by another programme than METSO				-		
	0					
	1					
I know someone who has a METSO forest site				-		
	0					
	1					
I have heard about the METSO Programme				-		
	0					
	1					
I first heard about the METSO Programme in this survey				-		
	0					
	1					
Evaluate the following statements in terms of your own forest management and forest property						
I need more information about the features of my forest to consider joining the conservation program				0,000		
	Argee	79	75		0,45	0,71
	Other	98	31			
Instead of a lump sum, I would prefer an annual payment for the program				0,000		
	Argee	65	67		0,37	0,63
	Other	112	39			
The transition to continuous cover forestry will make a significant contribution to maintain forest carbon stora				ei eroa		
	Argee					
	Other					
Carbon offsetting is the climate policy of the future				-		
	Argee					
	Other					
The weak state of Finland's forest biodiversity is exaggerated				-		
	Argee					
	Other					
Increasing deforestation cannot increase carbon sequestration				-		
	Argee					
	Other					
The impact of forestry in waters is exaggerated				-		
	Argee					
	Other					
Forest biodiversity can be increased through forest management activities				-		
	Argee					
	Other					
I do not want to think of natural resources as a market commodity				-		
	Argee					
	Other					
It is important to keep the felling potential of the forest holding stable				-		
	Argee					
	Other					
Old forests must be preserved for future generations				-		
	Argee					
	Other					
I am planning to sell my forest property				-		
	Argee					
	Other					
Increasing deforestation impairs the conservation of biodiversity				-		
	Argee					
	Other					

I am proud to know that my forest provides benefits to society in addition to my own benefits				0,009		
	Argee	53	48		0,30	0,45
	Other	124	58			
I am planning to alienate my forest to my heirs				-		
	Argee					
	Other					
The economic exploitation of commercial forests is the best climate policy				-		
	Argee					
	Other					
Evaluate the following statements in terms of your own forest management and forest property						
I understand the importance of forestry in climate change mitigation				-		
	Argee					
	Other					
I am concerned that the climate change could significantly increase the risk of forest damage				-		
	Argee					
	Other					
My family tends to leave part of the forest out of timber production				0,004		
	Argee	99	40		0,56	0,38
	Other	77	64			
I am not interested in protecting biodiversity in my forest				0,02		
	Argee	18	21		0,10	0,20
	Other	158	83			
Simultaneous protection of forest biodiversity and carbon storage is possible on my forest holding				0,04		
	Argee	129	64		0,73	0,62
	Other	47	40			
I would rather sell my forest property to a nature conservation organization than to any other private buyer				-		
	Argee					
	Other					
I am interested in participating in the carbon trade				0,000		
	Argee	74	12		0,42	0,12
	Other	102	92			
The conservation values of my forest depend on how the forest is managed on neighbor forest holdings				-		
	Argee					
	Other					
I have a duty to protect nature				-		
	Argee					
	Other					
My family and / or loved ones think that forest protection is a good deed				-		
	Argee					
	Other					
My forest offers me aesthetic experiences				-		
	Argee					
	Other					
I do not support the idea of restrictions on forest management				-		
	Argee					
	Other					
I am interested in active nature management that promotes biodiversity				0,001		
	Argee	129	56		0,73	0,54
	Other	47	48			
How important do you consider the following factors for the sustainability of Finnish forestry?						
[Very important=5, 4,…, Not important at all=1, I cannot say]						
Cuttings are decreased to protect biodiversity				-		
	Important					
	Other					
Forest reserves are increased to obtain larger carbon storages				-		
	Important					
	Other					
A forest owner receives a reasonable price for timber				-		
	Important					
	Other					

By-products of forest industry are used to produce biofuels			-			
	Important					
	Other					
Forestry employs many people			-			
	Important					
	Other					
Timber cuttings are decreased to mitigate climate change			-			
	Important					
	Other					
Fossil materials and fuels are replaced by raw wood materials			-			
	Important					
	Other					
Which of the following options describe your situation?			-			
	I permanently live in the forest holding					
	My leisure home is in the forest holding					
	The forest holding is not related to residency					
	I cannot say					
I permanently live in the forest holding			-			
Other						
My leisure home is in the forest holding			-			
Other						
The forest holding is not related to residency			-			
Other						
In which of the following organizations are you in/a member?						
	Forest owner organization		-			
	0					
	1					
	The Central Union of Agricultural Producers and Forest Owners (MTK)		-			
	0					
	1					
	Other forest owner organization e.g. local		-			
	0					
	1					
	A contact customer of a forest company			0,015		
	0	130	90			
	1	45	14		0,26	0,13
	Conservation organization		-			
	0					
	1					
	Hunting club (renter)			0,036		
	0	76	32			
	1	99	72		0,57	0,69
	Hunting club (a member)		-			
	0					
	1					
	None of these		-			
	0					
	1					
	I cannot say		-			
	0					
	1					
How old are you?		Ka		0,006		
		56,83	61,18			
Agemax40				0,016		
	Max 40	9	14		0,05	0,13
	More than 40	169	93		0,95	0,87

By-products of forest industry are used to produce biofuels			-			
	Important					
	Other					
Forestry employs many people			-			
	Important					
	Other					
Timber cuttings are decreased to mitigate climate change			-			
	Important					
	Other					
Fossil materials and fuels are replaced by raw wood materials			-			
	Important					
	Other					
Which of the following options describe your situation?			-			
	I permanently live in the forest holding					
	My leisure home is in the forest holding					
	The forest holding is not related to residency					
	I cannot say					
I permanently live in the forest holding			-			
Other						
My leisure home is in the forest holding			-			
Other						
The forest holding is not related to residency			-			
Other						
In which of the following organizations are you in/a member?						
	Forest owner organization		-			
	0					
	1					
	The Central Union of Agricultural Producers and Forest Owners (MTK)		-			
	0					
	1					
	Other forest owner organization e.g. local		-			
	0					
	1					
	A contact customer of a forest company			0,015		
	0	130	90			
	1	45	14		0,26	0,13
	Conservation organization		-			
	0					
	1					
	Hunting club (renter)			0,036		
	0	76	32			
	1	99	72		0,57	0,69
	Hunting club (a member)		-			
	0					
	1					
	None of these		-			
	0					
	1					
	I cannot say		-			
	0					
	1					
How old are you?		Ka		0,006		
		56,83	61,18			
Agemax40				0,016		
	Max 40	9	14		0,05	0,13
	More than 40	169	93		0,95	0,87